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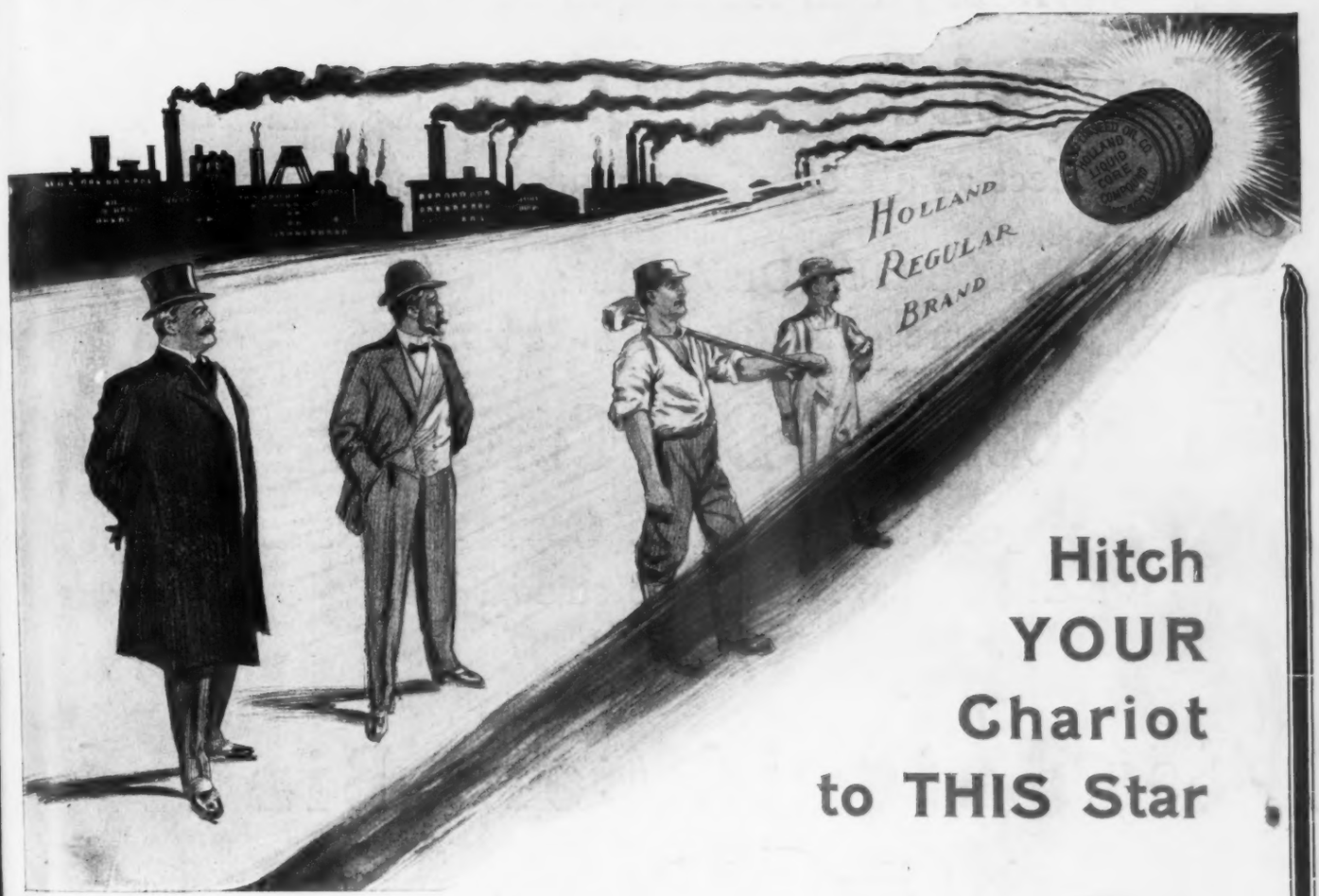
THE FOUNDRY



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Its rays reveal the satisfied molder, the result-getting foreman, the pleased manager, the thriving and happy proprietor. Let it also guide your destiny.

Satisfaction reigns in every foundry now using

Holland Liquid Core Compound

It makes BETTER CORES with less oil—cores that will not break—cores that will not absorb moisture.

Holland Liquid Core Compound is blow-proof—try it. It is an oil core binder, makes ventless cores and is most economical.

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"Kantbebeat" Dry Core Compound

As perfect as a Core Compound can be manufactured.

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We are going to convince you that

"Kantbebeat" Dry Core Compound

is as good as **702 Pure Ceylon Plumbago**
which you have made the standard.

If **Wet**

Esso Liquid Core Binder

Good, economical and right. Substitute
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respecting our modern Crucible Furnace as to "economy", "quick handling and melting" of metals in equitable time to avoid "excessive oxidation" it appeals to the progressive

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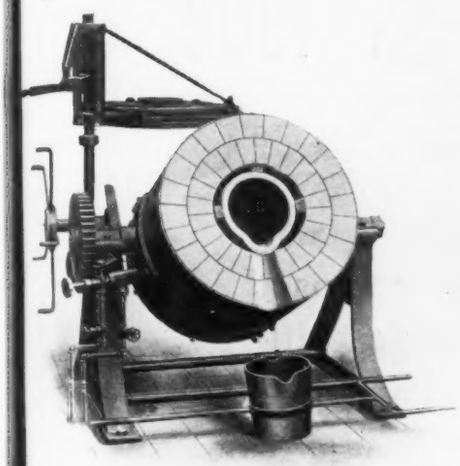

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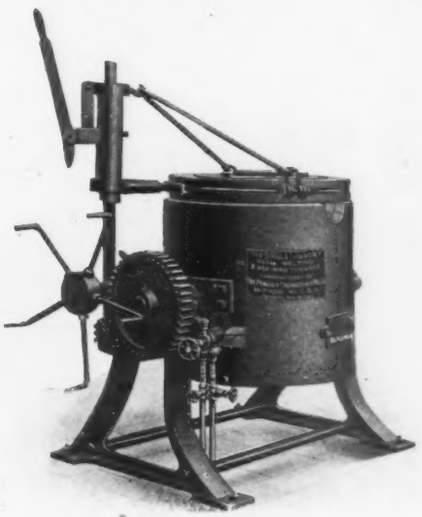

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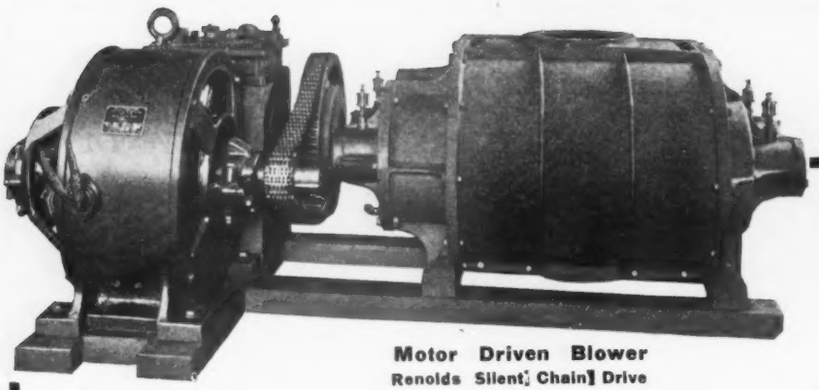

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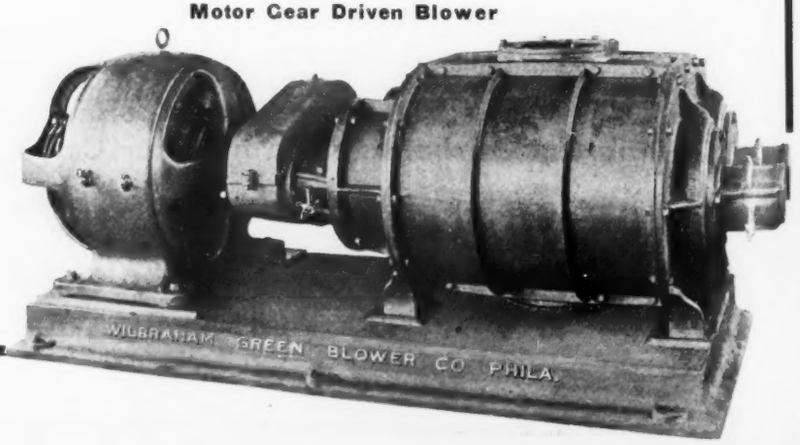

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With a STURTEVANT Electric Propeller Fan

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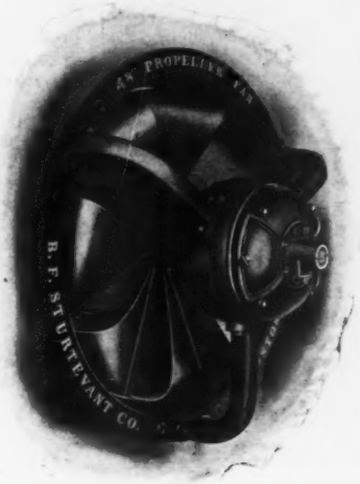

Send for Bulletin No. 146

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We Can Furnish Either a Fan or a Positive Blower As You Prefer

Both types are made in the same shop; we advise without prejudice. We make, also, motors and engines for driving.

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Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus; Fan Blowers and Exhausters, Rotary Blowers and Exhausters; Steam Engines, Steam Turbines, Electric Motors and Generating Sets; Pneumatic Separators; Dust Collectors, Fuel Economizers, Forges, Exhaust Heads, Steam Traps, etc.

630

H. E. MILLS, PREST.

The H. E. Mills Mfg. Co.

Manufacturers of

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DRY CORE COMPOUNDS

Don't let well enough alone—
improve. — This is our motto.
Why not make it yours?

"MILLS' DRY CORE COMPOUNDS are the recognized standard of the Foundry world. Our experience for past seven (7) years ought to give us precedence over all imitative competition. It costs less to use the best."

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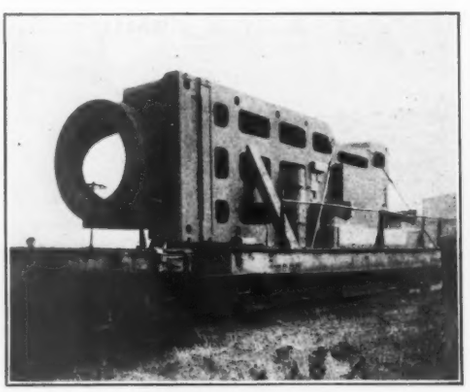

OUR QUALITY

MERITS

YOUR TRIAL

75-ton Casting made with Mills' Dry Core Compound by Buffalo Foundry Company

H. E. Mills Mfg. Company,
Syracuse, N. Y.

Buffalo, N. Y., April 30, 1908.

Gentlemen:—Replying to yours of the 23rd inst., would say that we have used **Mills Core Compound** in our Core Department about four (4) years, and are now using it exclusively. It has always given excellent results in our large core work, and we have used it with success in a mixture for skin dry moulding in place of the regular dry sand facing. Once used it speaks for itself, and we take pleasure in recommending it highly.

Yours very truly,
BUFFALO FOUNDRY COMPANY,
P. J. Krentz, Superintendent.

P. J. K.-B.

Syracuse Liquid Core Compounds

Our brands X, XX, XXX, and XL can be used for all purposes, where a liquid binder is essential.

H. E. Mills Mfg. Company
City

Syracuse, N. Y., U. S. A., May 5, 1908.

Gentlemen:—We are pleased to state we have used the **Syracuse Liquid Core Compounds** ever since you started their manufacture, and they have given us the best of satisfaction. We have used this material on both our boiler and radiator work, and have been able to obtain a good, clean core at a minimum cost, and we expect to continue the use of same.

Yours very truly,
PIERCE, BUTLER & PIERCE MFG. CO.,
Thos. Wheatley, Vice-Pres. and Treas.

THE H. E. MILLS MFG. COMPANY

Cleveland **Syracuse** **Milwaukee**

Main Offices, SYRACUSE, N. Y.

With flour at $30 per ton and weighing 1¼ lbs. to the quart:

In the proportion of	To bind one ton of sand with flour would cost	To obtain an equal result with glutrin would cost
1 to 10 1 to 40	$1.40	70 cts.
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ROBESON PROCESS COMPANY
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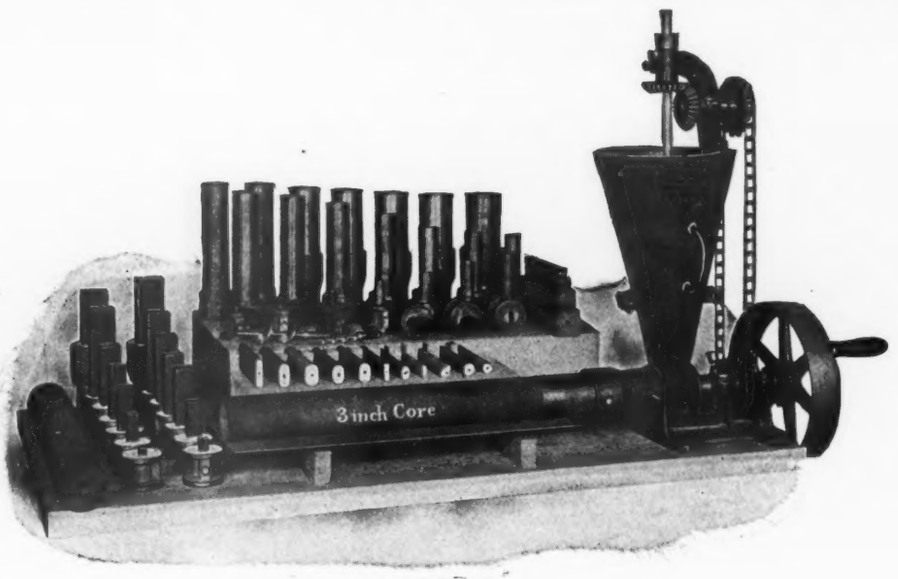
ALL MADE ON ONE MACHINE



The Hammer Core Machine

(The Original Core Machine)

is now equipped to make

Round Cores 1-4 inch to 3 inches.
Square Cores 1-4 inch to 2 inches.
Oval Cores up to 3 inches.
Irregular Shapes to 3 inches.

This machine has a greater range than any Core Machine on the market.
We guarantee our machines to give satisfaction.
Over 1500 of these machines are now in successful operation.
Our sales of Core Machines are larger than those of all other makes combined.

Write for our New Catalog.

BROWN SPECIALTY-MACHINERY CO.

Manufacturers

Corner Jackson Blvd. and Clinton St. **CHICAGO, ILL.**

THOMAS W. PANGBORN COMPANY
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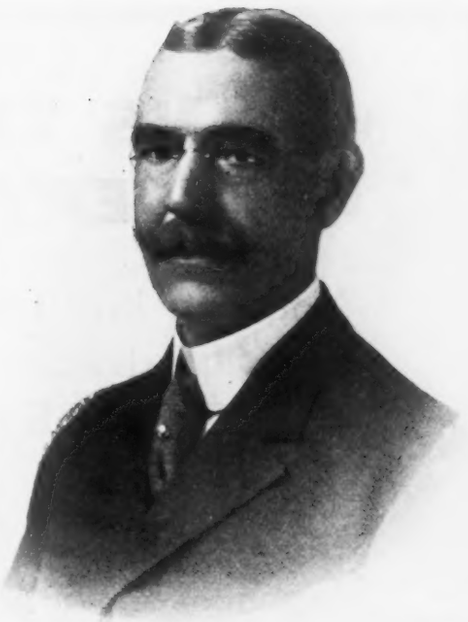
Exclusive Sales Agents for the Atlantic Coast States, Vermont, W. Virginia, Pennsylvania and Eastern Canada.

Personal



After the menace of all the "bugaboos" of "hard times," a careful examination, not of suppositions but of facts, indicates a dawn in the east which betokens a better day.

The volume of bank clearings has been maintained for several months and now show a substantial increase.

We now have lower interest rates and freer credits so essential to business activity. The monthly number of commercial failures since January has been greatly reduced. For six months the demand for steel and pig iron has shown little variation until the last half of May when the upward turn began and has been maintained. So the thoughtful man who believes, not in signs but in facts, may feel encouraged.

Personal application to business needs has never been so greatly stimulated as it has been during these days of business depression, and never was it more necessary.

Prosperity, in a great degree, engenders self-satisfaction and self-satisfaction breeds neglect, so a little adversity now and then acts as a tonic when taken in the right spirit.

I began long ago giving personal attention to the details of my business and have never outgrown the habit. It has become a pleasure. My business is not so big that it will run itself, hence the "demnition grind" becomes a necessity, but an agreeable one, at that.

I manufacture FOUNDRY FACINGS, SUPPLIES, BUFFING COMPOSITIONS and PLATERS' SUPPLIES, CUPOLA BLOCKS, FIRE BRICK and the sundry and divers things used in a successful establishment where the use of such material of the best quality is desired.

I am running my business in what may seem a new way to you. I am trying to make it so easy for you to buy your supplies of me that it would not be a greater convenience to you if I had a branch in your town.

If you buy anything of me which does not come up to your expectations, send it back and get your money back.

You cannot want anything in too great a hurry to suit me. If it is easier and better for you, use the Long Distance Telephone.

I will pay for that.

If there is anything you want or anything you want to know, or if you have any "kick coming," write me. I would rather have your orders than your "kicks," but I would rather have your "kicks" than to have you feel the least bit dissatisfied with anything you buy of me.

I do not know it all, but am learning something every day. I would like more letters daily on the interesting subject of Foundry Practice. Suppose you, "gentle reader," start the Correspondence School. I will try to make it interesting.

FREDERIC B. STEVENS

DETROIT, MICH.

FACING MILL	WAREHOUSE AND OFFICE	EXPORT WAREHOUSE
Cor. Isabella Ave. and M. C. R.R.	Cor. Larned and Third Sts.	Windsor, Ont.

See Page 127

Address all letters Detroit, Mich., that's enough.

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FIRE SANDS AND CLAYS, SILICA SANDS, ETC.
Direct to you from our own banks. Quickest deliveries and lowest freight rates.

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BLAST SANDS

PETTINOS BROTHERS

PRODUCERS

PLUMBAGO AND FOUNDRY MATERIALS

BETHLEHEM, PA.

NEW YORK **PHILADELPHIA**

Established 1894 Incorporated 1901

WE ARE PIONEERS

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Metallic Fluxes and Alloys For Grey Iron Foundries

¶ GROUND 80% FERRO-MANGANESE is an old story with us. Years ago we introduced the practice to grey iron foundries in a little book "Manganese in the Foundry." It said, "Experience will show that Ferro-Manganese is a valuable adjunct in foundry practice for nearly all classes of castings."

¶ That has proved true, hundreds of foundries have, as a result, adopted it, and as we are the original we are still the largest makers of Ground, Pea, and Nut-size Ferro-Manganese for iron foundries.

¶ There are other excellent Metallic fluxes for cast iron, for special purposes, best used in the ladle, Ferro-Silicon, 50%, 75% and 90%, Granulated Aluminum, Manganese-Silicon, Ferro-Aluminum 10% and 25%, Ferro-Titanium 12% and 58%, etc.

¶ We have them all, in pulverized, pea and lump form.

Best of all for general foundry use is ☞

TRADE MARK
Carbanese
REG. IN U.S. PAT. OFF.

Highest Award Worlds Fair St. Louis, 1904.

Pulverized and briquetted for any sized ladle. Order direct, to avoid substitution.

Made and sold exclusively by

Midvale Mining & Mfg. Co.

Metallic Fluxes and Alloys **ST. LOUIS, MO.**

It's Money in Your Pocket

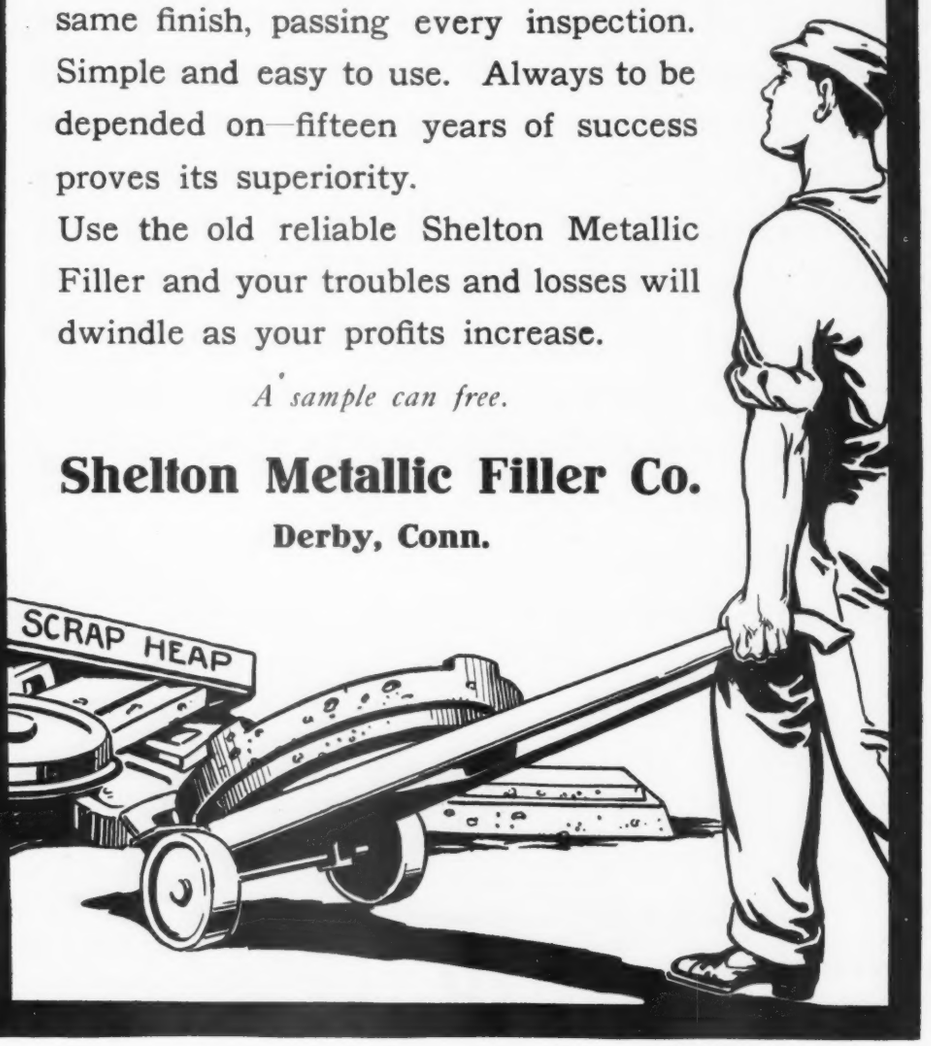
TO USE A FILLER THAT
FILLS TO STAY FILLED

Shelton Metallic Filler becomes a part of the casting itself, taking the same finish, passing every inspection. Simple and easy to use. Always to be depended on—fifteen years of success proves its superiority.

Use the old reliable Shelton Metallic Filler and your troubles and losses will dwindle as your profits increase.

A sample can free.

Shelton Metallic Filler Co.
Derby, Conn.



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The House of
DRUMMOND & McCALL
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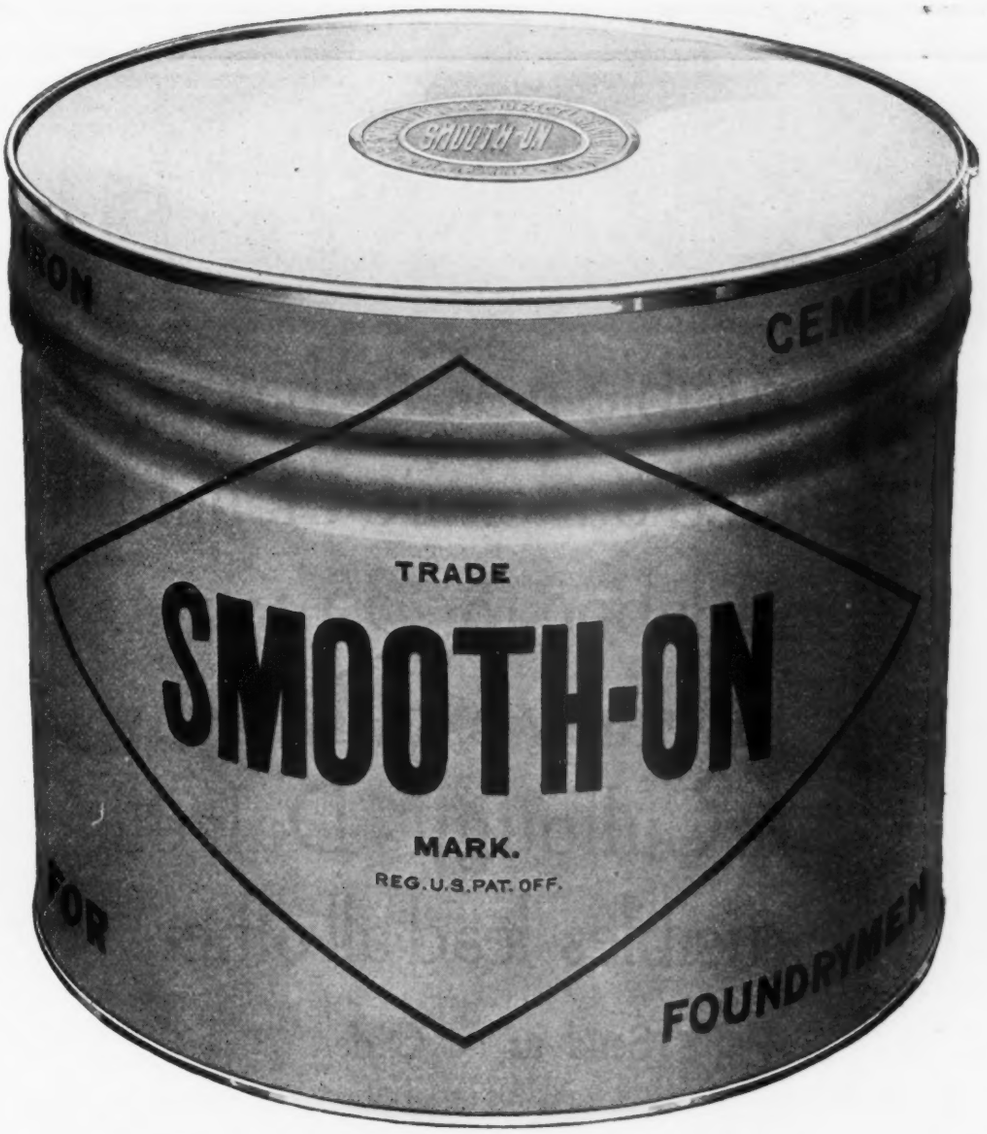
supply the foundry trade of the Dominion with

SHELTON METALLIC FILLER



SMOOTH-ON CASTINGS is a chemical iron compound that will metallize in a few hours and become a part of the casting with the same color and appearance.

ACCEPT NO SUBSTITUTE which may be offered as "Just as good." There is nothing to equal the Smooth-On products for durability and efficiency. Our new illustrated instruction book is free.

SMOOTH-ON MFG. CO.

Jersey City, N. J., U. S. A.

Chicago Warehouse: 61 N. Jefferson St.

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English Branch: 8 White St., Moorfields, London, E. C.

If your supply house does not keep this cement, send us their name.

Crucible-making has engaged our entire thought and labor for 35 years. This partly explains why McCullough - Dalzell Crucibles lead all others.

Send us an Order.

McCullough-Dalzell Crucible Co.

Pittsburgh
Pa.

THE FOUNDRY

Vol. 32, No. 5 CLEVELAND, OHIO, JULY, 1908 Whole No. 191

STRAIGHT FLOOR CAR WHEEL FOUNDRY

Practice Pursued in the New Plant of the Dickson Car Wheel Co., Houston, Texas

PERATING methods in no branch of the foundry industry have reached a higher development than in the manufacture of cast iron car wheels. From this progress has been evolved a standard method known as the straight line system, and the new plant of the Dickson Car Wheel Co., Houston, Tex., has been designed and is equipped to operate by this method. In previous years the advance in car wheel practice was largely limited to mixtures, wheel designs, etc., and to the later development has been added the item of foundry engineering and the use of labor saving machinery, facilitating production and resulting in an increased output. This plant is operated on practically a continuous system, the raw material being converted into finished castings without any reverse movements.

The straight floor system was first introduced within the last two decades. In the early plants the cupola was placed in the center of one end of the foundry and the hot wheels were pitted back of the floors, these pits extending the entire length of the shop. There were furthermore, only 20 wheels to a floor, as compared with 25 in this plant. The distance from center to center of the floors was only 9 feet, as against 12 in this foundry. The scrap wheels are broken up in the yard by a pneumatic breaker and the entire yard is laid

FIG. 1—VIEW OF ONE SECTION OF THE FOUNDRY LOOKING TOWARDS THE CUPOLA

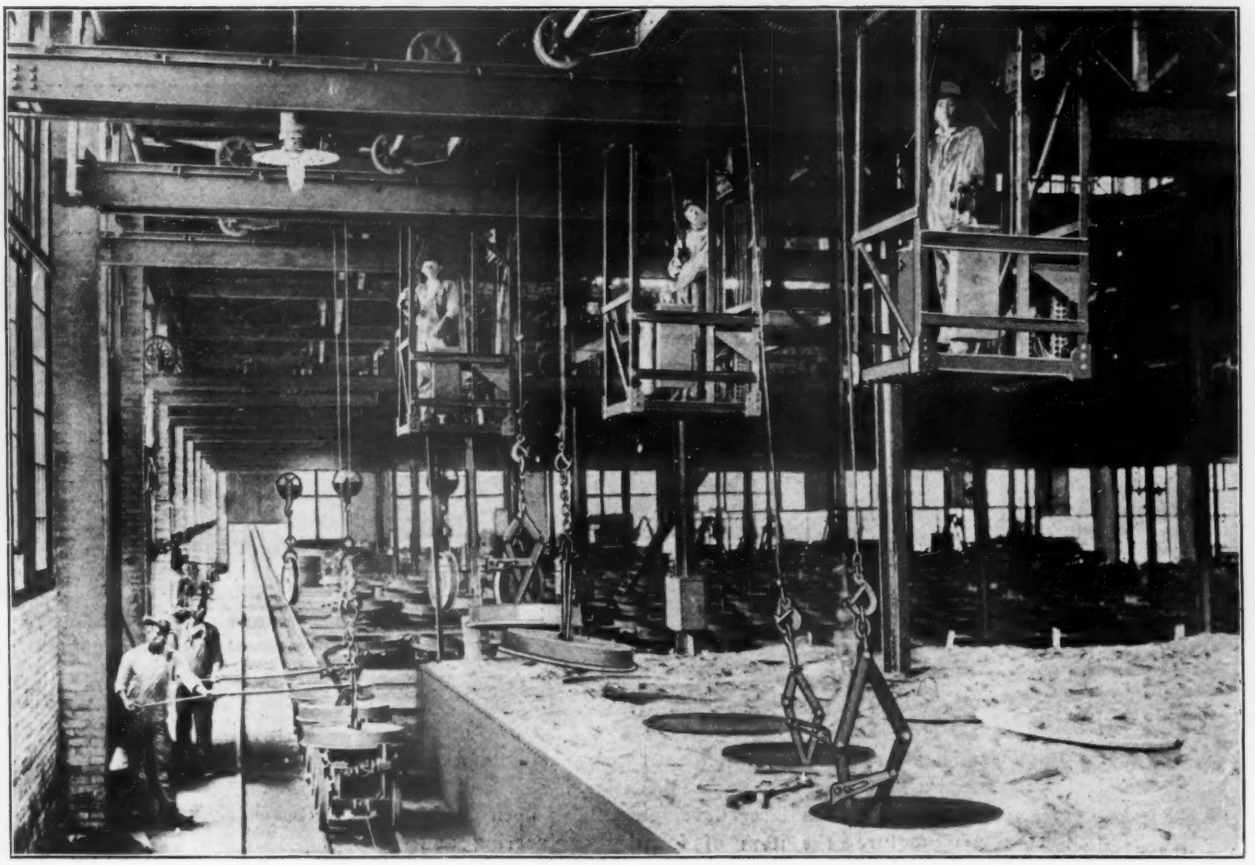


FIG. 2—ANNEALING PITS SERVED BY OVERHEAD CRANES

out with a complete system of tracks so that all material is brought to one central point on industrial cars, loaded onto steel charging buggies, elevated to the charging platform by the use of an air hoist, mechanically lifted and dumped into the cupola. The cupola is one of the largest ever built, having an inside diameter of 102 inches. Blast is furnished by a high pressure blower and is controlled by an automatic registering pressure recorder. The metal is tapped into a 10-ton mixing reservoir electrically operated. It is also fitted with hand

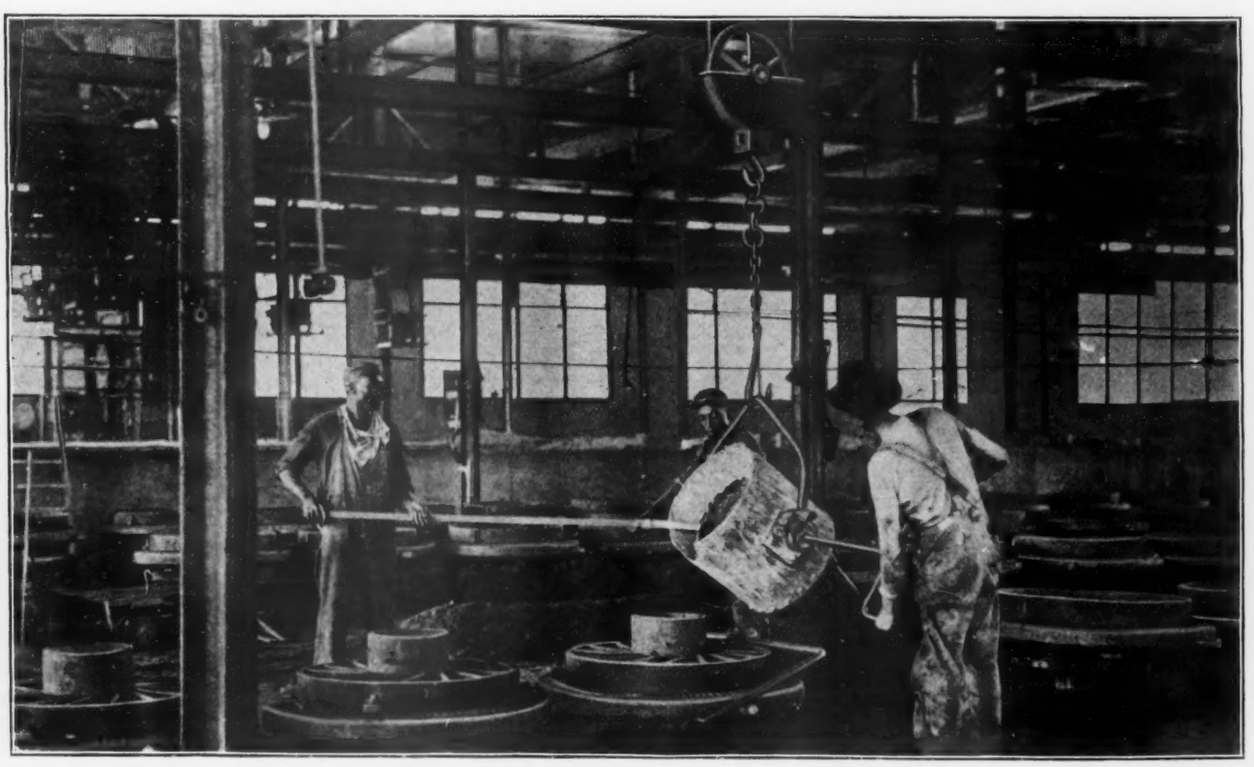


FIG. 3—OVERHEAD TROLLEY FOR HANDLING LADLES

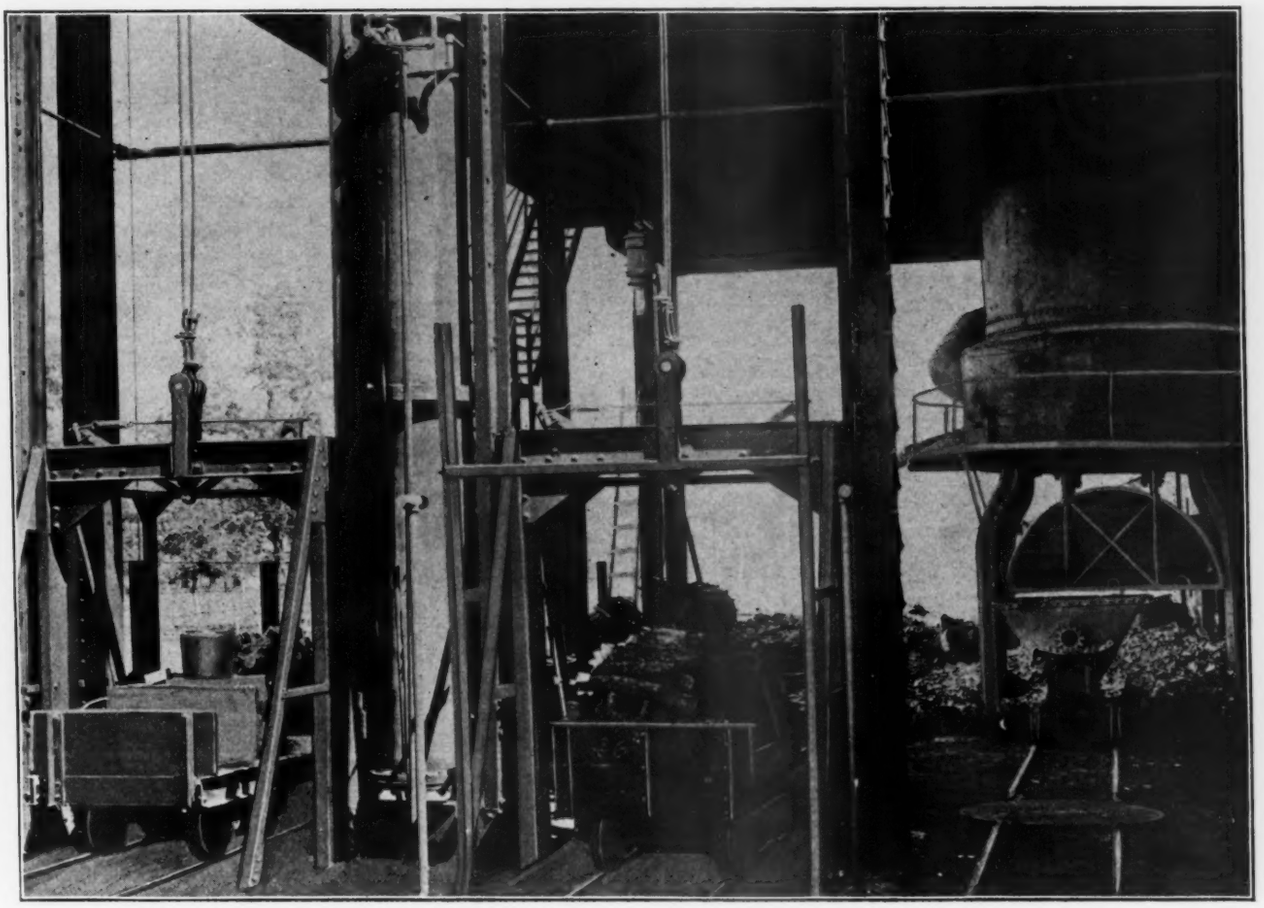


FIG. 4—CHARGING FLOOR ELEVATORS

power attachment for emergency use. The iron is taken away from the reservoir by an electrically driven tramway system and delivered to the molders. The electrically operated overhead carriers convey the iron from the end of the floor to the different points where the molds are located and where they are to be poured. The same traveler takes the wheel and delivers it to another electrical tramway system at the end of this floor. Pneumatic hoists are provided for raising and lowering ladles, wheels, etc.

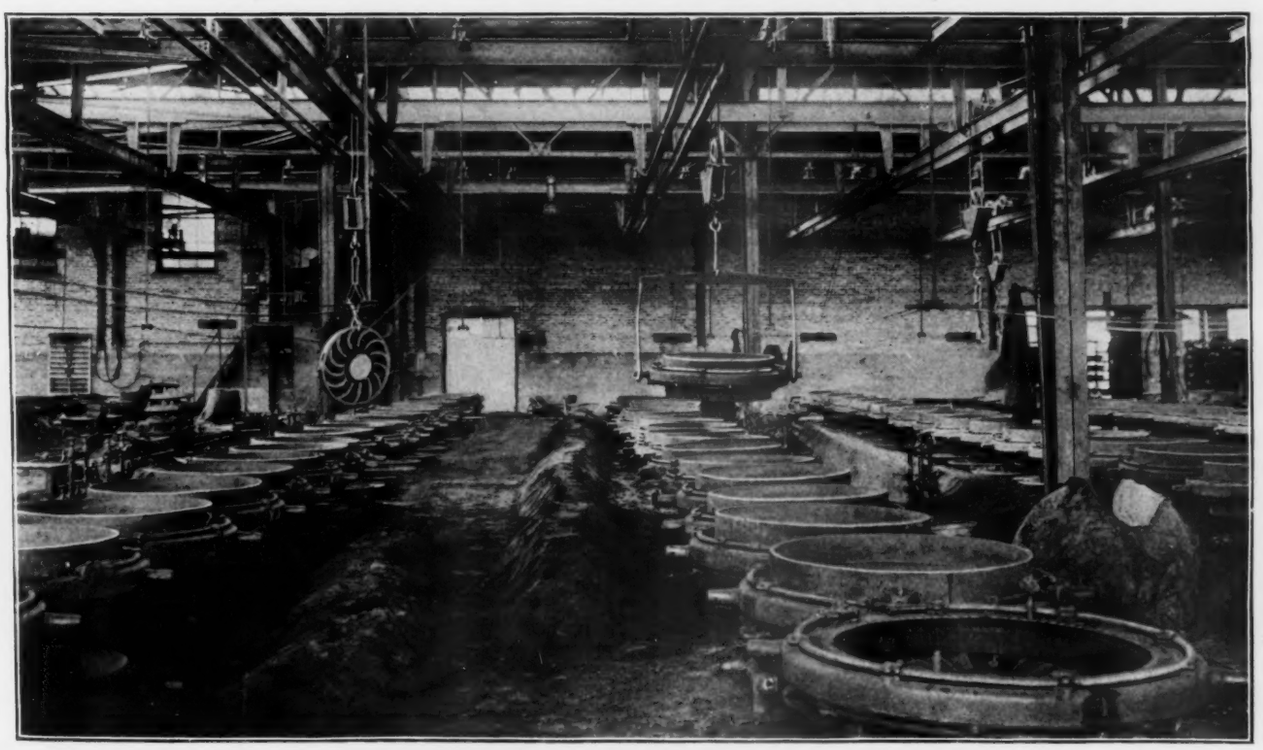


FIG. 5—OVERHEAD TROLLEYS FOR HANDLING THE WHEELS AND THE FLASKS

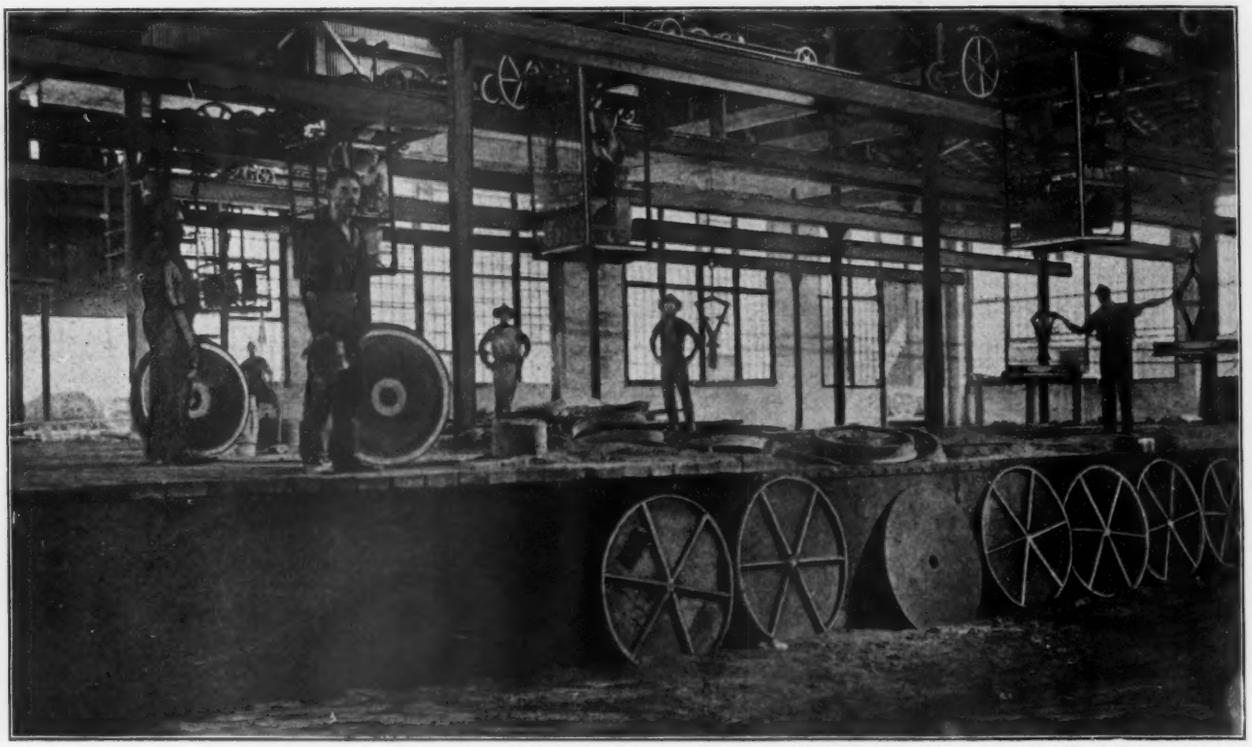


FIG. 6—ANOTHER VIEW OF THE ANNEALING PITS

The control of all these movements by the molder is accomplished through a system of rope transmission so that the molder can stand at any portion of his floor and control all operations.

The hot wheels are delivered by an electric tramway to a set of pitting cranes which take the wheels out of the pits after they have been thoroughly annealed and deliver them to the cleaning department, which is raised above the level of the foundry floor to the height of the average car floor. The wheels are then cleaned and rolled directly into cars for shipment. The entire system of floors, pits, etc., is laid out to exact centers so that there is no shifting required when hot wheels or iron are taken from one place to another.

The plant has a capacity of 400 wheels a day and the entire power equipment, with the exception of the pitting cranes, was installed by the Whiting Foundry Equipment Co., Harvey, Ill. As shown in the ground plan, Fig. 10, the foundry is divided into 16 floors, with provisions on each floor for 26 chills. The building

FIG. 7—PLANT OF THE DICKSON CAR WHEEL CO.

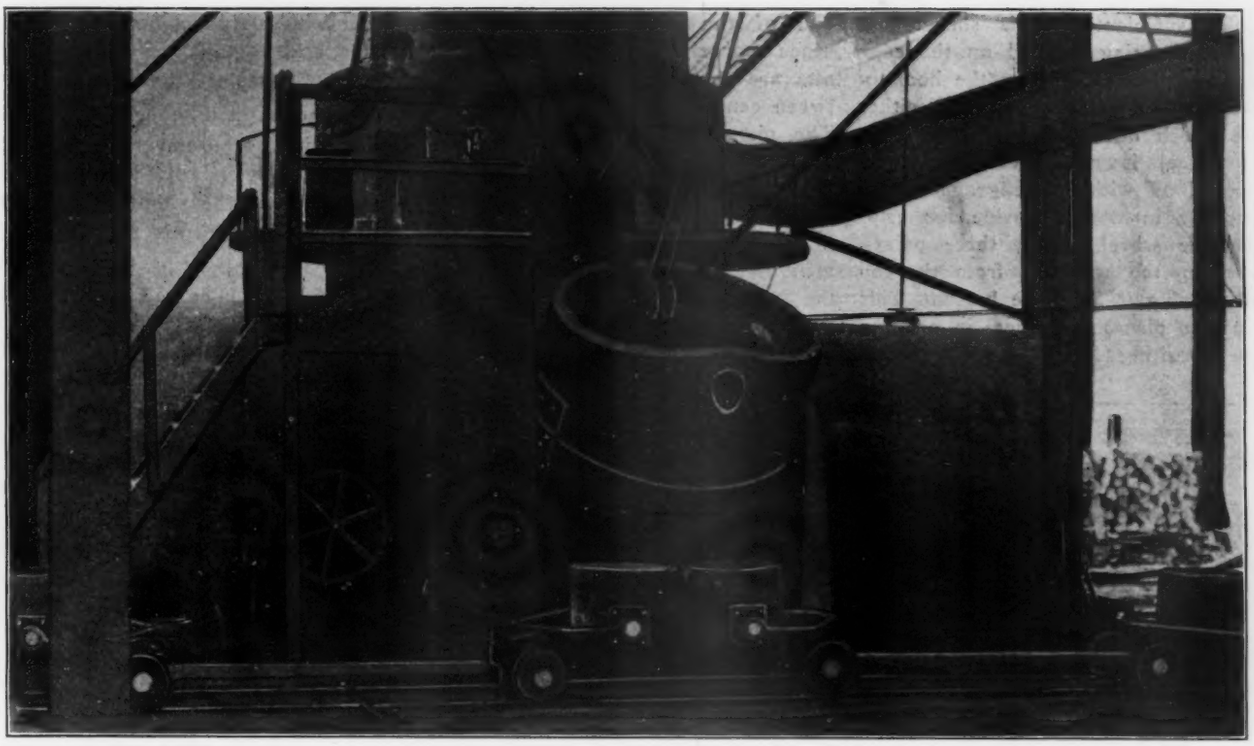


FIG. 8—RESERVOIR LADLE AND LADLE BUGGY

is of brick and steel construction throughout, 264 feet long and 135 feet wide. The 16 floors occupy a space 192 x 135 feet. The cupola room is 30 x 72 feet and adjoins one side of the center of the plant. The hot metal track extends the length of the foundry, directly in front of the cupola, as shown in Fig. 8. Above each floor is a traveling trolley from which a block and hook controlled by a pneumatic hoist at one end are suspended. The cylinder and valves for the hoist are attached to the wall on the side of the foundry opposite the cupola, out of the way of the dust and dirt of the foundry floor. As shown in Figs. 3 and 5 the hoists are used for pouring metal as well as handling the heavy flasks used in car wheel practice. When shaking out, the wheel is gripped on the side and carried across the floor to the hot wheel buggies.

The hot metal cars which convey the ladles to each of the floors operate on a narrow gage track, each traversing half the length of the foundry on the cupola side. These ladles have a pouring capacity of 1,000 pounds each. After the wheel is

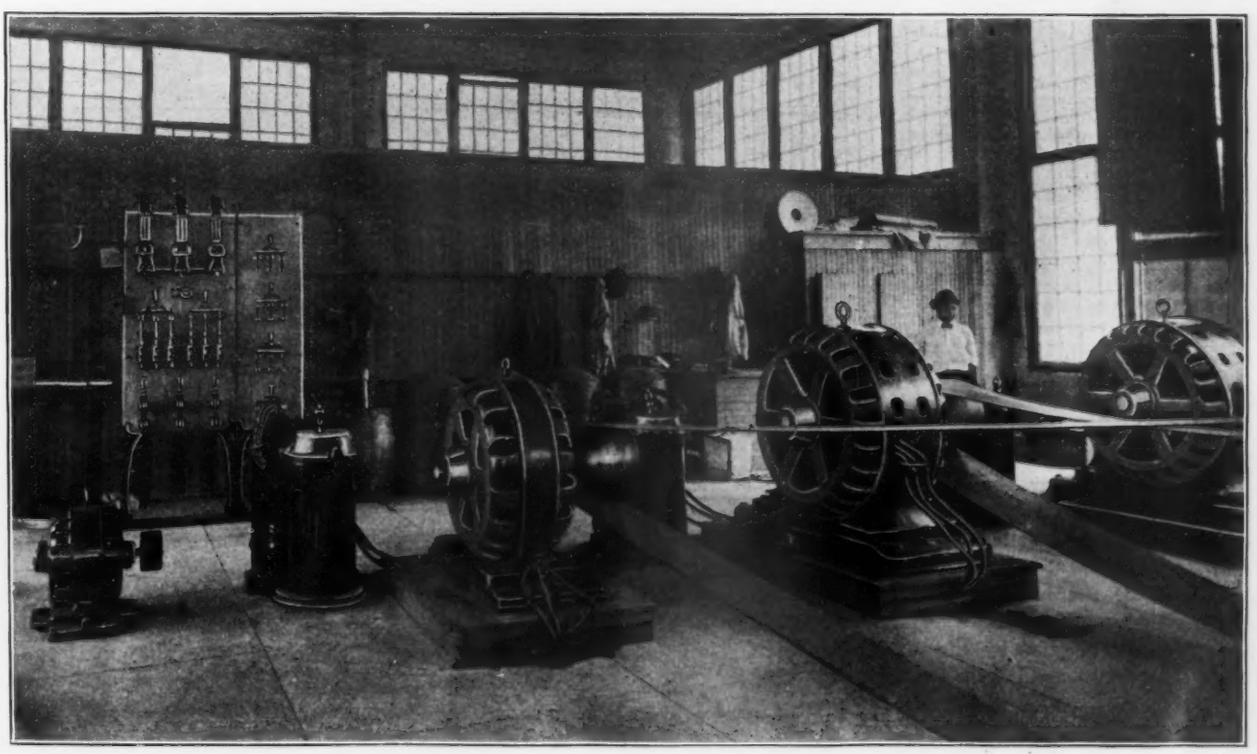


FIG. 9—POWER PLANT

cooled sufficiently, it is shaken out and upon being gripped on the edge by tongs depending from the hook of the hoist, the loose sand on either side which does not fall away when the wheel is raised can be easily knocked off with a sledge. Methods generally in vogue provide for gripping the wheel flat at three points, shoveling the hot sand from the top and rapping it from the bottom. This grip also places the wheel in position for depositing it on the hot wheel buggies which convey the wheels to the annealing pits. The movement of these buggies is controlled by an operator located in a stationary pulpit at the side of the building overlooking the tracks. Before the wheels are lifted from the buggies by the pitting cranes, their heads are knocked off and the center cores are knocked out.

Annealing Pits.

The annealing pits are located in one end of the foundry and occupy a space approximately 60 x 60 feet. The pits are spaced 4 feet, 4 inches between centers and are 120 in number. The pits are served by four cranes as shown in Figs. 2 and 6. Each of the sixteen floor hoists consists of a traveler operating on elevated tracks.

The backward and forward movement of the travelers and the lift of the hoists are controlled by separate hand ropes suspended about 6 feet above the foundry floor. The ropes are so arranged that a pull in either direction results in a like movement of the trolley. This materially assists the operator and is of inestimable value in the handling of the pouring ladles. The hoisting movement of each trolley is accomplished by an independent cylinder of the air balanced type provided with a top head arranged for attaching to the building framework and a bottom head provided with a stuffing box for a piston rod.

Conveying the Metal.

As shown in Fig. 8, the metal is tapped into a 10-ton receiving ladle which is eletcrically tilted, and is operated from the pulpit by the same operator who controls the ladle cars. The receiving ladle is equipped with a skimming spout and is provided with an emergency hand power mechanism underneath the operator's platform, which is shielded by steel plate work as shown.

The cupola charging floor shown in Fig. 12 is served by two 3-ton pneumatic elevators shown in Fig. 4. Each elevator is provided with tracks on which the coke and pig iron and scrap charging buggies are carried from the ground floor to the charging room. The charging floor is provided with four main tracks and turntables,

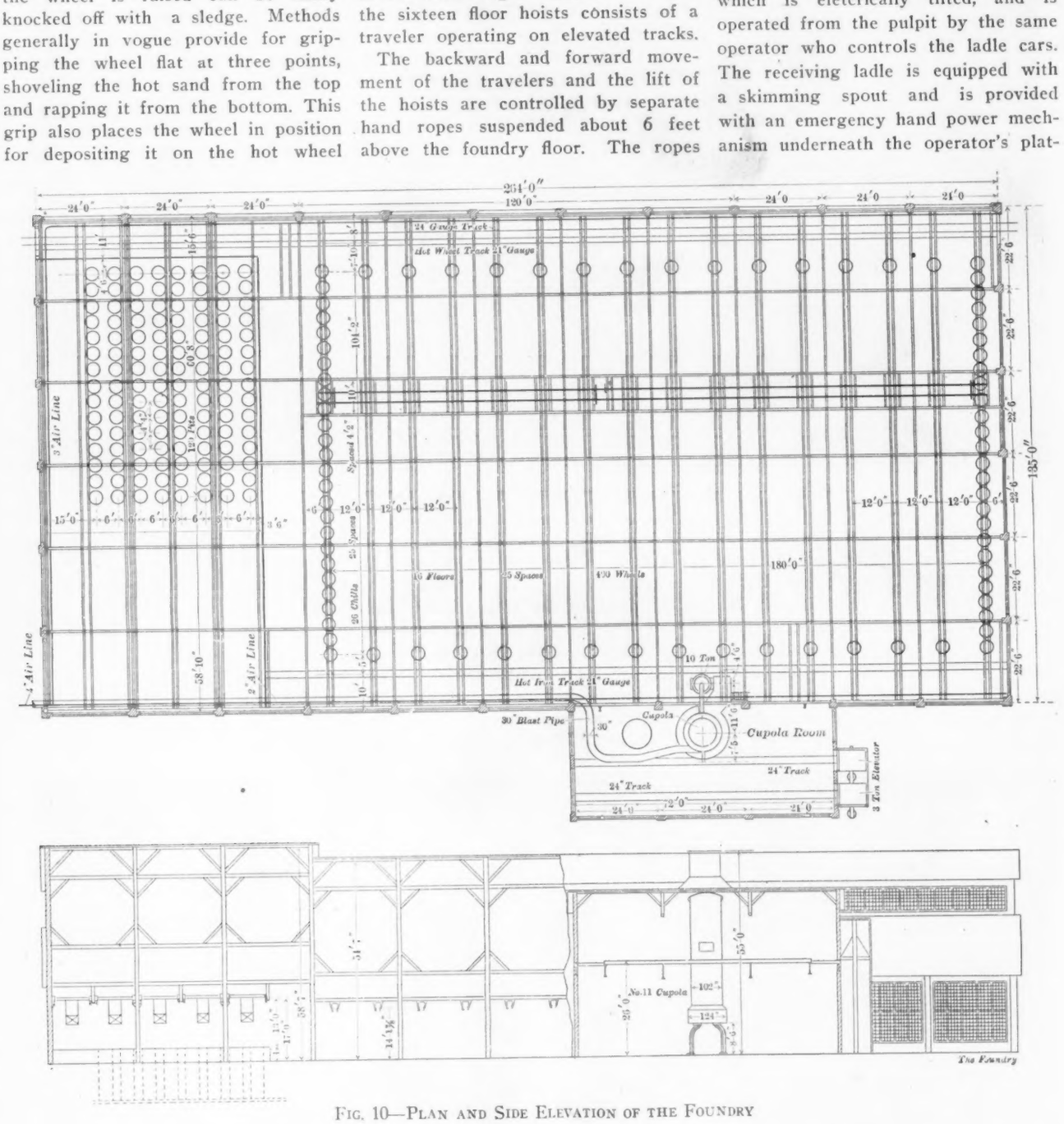


FIG. 10—PLAN AND SIDE ELEVATION OF THE FOUNDRY

as well as two tracks for storage purposes. The charges are dumped into the cupolas by means of a charging machine.

Core Department.

The core department is located in a separate building 36 x 100 feet and is connected with the foundry by industrial tracks. It is equipped with large stationary core ovens and is provided with pneumatic sand mixers, etc. Adjoining this building is the core and sand storage shed, which is so located that the sand is unloaded directly into this storage room, thus doing away with all extra handling. The store room for other material parallels the railroad tracks and is connected by tramways to the other departments. All material is given out either by weight or measure and an accurate record is thereby insured of the stock on hand, and the daily cost of material consumed can easily be arrived at.

Power Plant.

The power house is 40 x 72 feet and is equipped with air compressors, motors, blowers, etc., electrically driven. The water supply is obtained from a well 820 feet deep and is elevated 100 feet to a 30,000-gallon tank. The buildings are of white brick construction and are provided with terra cotta tile roofs and have almost continuous rows of high windows extending round the four sides of the building to insure ample light and ventilation. A complete water system has also been installed for fire protection. The plant has been built on a site of nine acres which parallels the main line of the Southern Pacific railroad a distance of 1,500 feet and has an average width of 300 feet.

The officers of the company are John F. Dickson, Sr., president and treasurer; Henry H. Dickson, vice president; George M. Dickson, general sales agent; John F. Dickson, Jr., assistant general manager, and Eugene A. Heyck, secretary. The capital stock of the company is owned exclusively by the Dickson family.

ELECTRO-CHEMICAL CLEANING BATHS AND THEIR APPLICATION TO COMMERCIAL USES.*

By Chas. H. Proctor

In the art of electro-depositing metals, two conditions are absolutely necessary for successful results. The first is an absolutely chemically clean metallic surface; the second, the proper composition of the depositing bath. With these two essential preliminaries the results can never be in doubt.

In the days of the chemical battery, before the dynamo became the prime factor in the electro-deposition of metals on a commercial scale, the manner of cleansing the surface of the baser metal was practically the same in every case.

Early Practice.

In the years gone by so much care was exercised in cleaning the metallic surface that such metals as copper, bronze and brass, after being highly polished, were afterwards scoured by the aid of various substances, thereby producing a dull surface that was supposed to be a necessity, because the early operators were under the impression that the deposit would not adhere to a polished surface. At the present time we know that it is just as easy to produce a successful deposit upon a polished surface as upon a surface that is unfinished. There is always one factor to be taken care of and that is oxidation. As oxygen is always present in the atmosphere, it will, with its well known affinity for most metals, oftentimes in the space of a few moments form an oxide upon the surface of the metal which is invisible to the eye and yet sufficient in some baths, like nickel, to prevent a true adhesion of the deposited metal.

This is the reason no doubt that the early operators obtained many unsuccessful deposits and deemed it necessary to scour the surface with pulverized bath brick, trent sand, pulverized pumice stone and many other abrasive substances, that were intended to produce the purely clean surface so much desired, and until a decade or more ago, these same methods were carried on.

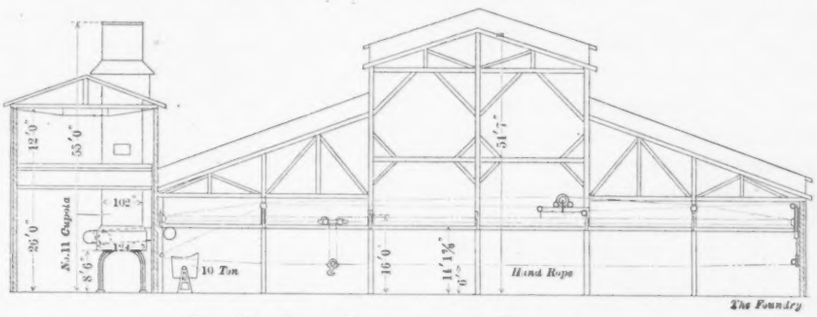


Fig. 11—Cross Section of the Foundry

New Method.

Within the past few years a number of substances of a chemical nature have appeared upon the market and have met with gratifying success, due to the fact that a chemically clean surface could be procured without oxidation or deterioration of the polished surface.

Several years ago it was announced that a well known manufacturer was cleansing his goods made of iron and steel by electricity, and for some time the minds of many platers were at work to know how this could be accomplished.

Finally came the light. It was announced that alkaline substances such as sodium carbonate, potassium carbonate, potassium hydroxide and sodium hydroxide in solution, in varying degrees of concentration and with small proportions of potassium cyanide added, would, with a sufficiently strong electric current of from 4 to 8 volts, and at a temperature nearly boiling, develop sufficient hydrogen to remove entirely all organic substances from the surface of the metal, thereby leaving it chemically clean.

The action of an electro-cleanser is similar to the action of an electro-plating bath. The only difference so far as the development of gases is concerned, is that no metal being in solution and the anode being insolu-

*Presented at the annual meeting of the American Brass Founders' Association.

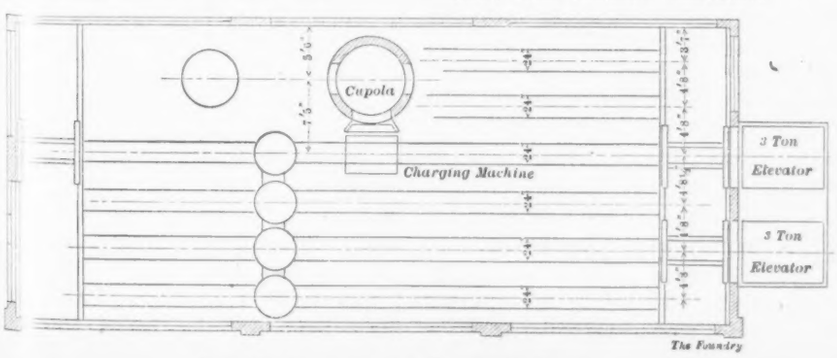


Fig. 12—Plan of the Charging Floor

ble, no metal is deposited. But with a strong current a copious evolution of oxy-hydrogen gas is developed upon the articles, which attacks the organic matter upon the surface, practically lifting it off and by rapid evolution of the gases carries it to the surface. The small quantity of potassium cyanide contained in solution absorbs the slight oxidation that might be upon the surface, and by the combined action produces a surface clean enough, after washing in clear water, for any deposits.

Cleaning Bath.

The arrangement of an electro-cleaning bath is very simple. Prepare a wrought iron tank of proportions best adapted to the amount of work to be cleansed. This should be heated with steam coils of iron. Across the top of the tank an insulated frame should be constructed. Upon this frame place three conducting poles, as on the regular plating bath. To the two outside poles the positive current should be carried direct. This can best be accomplished with at least ½-inch copper wire flexible cables. To the center pole the negative current is connected with cable of the same dimensions; no rheostats are necessary. The stronger the current the greater the evolution of gases and the quicker the cleansing operation is accomplished.

Although direct contact can be made with the positive current to the tank itself, in practice, better results have been obtained with anodes of sheet iron not more than 6 inches wide and of a length in proportion to the depth of the tank.

Electro-Cleaning Solution.

The electro-cleaning solution should consist (for ordinary purposes) of 3 to 4 ounces of caustic potash to each gallon of water, and to every 100 gallons of solution 8 ounces of cyanide of potassium. This can be varied according to conditions. It is advisable to add at least ¼-pound of cyanide each week. Where the articles, such as iron or steel, contain much oil or grease upon the surface, the density of the solution can be increased. For articles of brass, copper or bronze that have been polished, use a solution of carbonate of soda in the proportion of 2 ounces of soda and ½ ounce of caustic potash to each gallon of water, with the addition of 4 ounces of cyanide to every 100 gallons of solution. If much organic matter is upon the surface of the articles to be cleansed, it is advisable where an air pressure can be obtained from an ordinary blower, to arrange a pipe so that the current of air can be deflected upon the surface of the solution, thus keeping the center of the solution clear of the insoluble substance that rises to the surface. When the cleanser is at rest, as much of this matter should be removed as possible.

THE METALLURGY OF THE BRONZE AGE*

A Comprehensive Discussion of the Bronze Age in Europe Including a Reference to Mixtures and Early Practice

BY W. M. CORSE

THE progress of civilization, metallugically, divides itself into three periods. These three sub-divisions are commonly called the stone, bronze and iron ages and each shades into the other as do the colors of the rainbow. As the province of this paper is the bronze age, only reference will be made to the others. It is true, however, that mention is made of both bronze and copper in the literature relating to the stone age.

Copper.

The word for copper appears really to have signified metal and was used in its generic sense long after iron was known. On account of the gradual transference of the word meaning metal from copper to iron as the latter became the predominant metal it is hard to define the exact beginning of that period which we now term the bronze age. We have no record of any period in the history of the Aryan people in Europe when iron was unknown; so that, strictly speaking, the iron age as applied to these people covers that period when the use of bronze was given preference for weapons and implements on account of the lack of sufficient knowledge to work iron easily and profitably. This statement does not apply to the Egyptians and Chinese, whose history dates back beyond the Aryan immigration into Europe. The knowledge of the metallurgy of steel as applied to weapons seems to have been well known in Europe at the time of Polybius, born about B. C. 202, which date gives us an idea as to the end of the bronze age in that country.

The Copper Age.

Some relics point to the existence of a copper age in which the use of tin as an alloy in copper was unknown. In some parts of the world it was some time before the alloying of tin with copper to make it more readily fusible, and to increase its elasticity and hardness, was known. In Europe only a faint trace of a copper age is to be found, but in North America the Indians took the native copper and fashioned it into weapons and utensils long before the bronze age in Europe.

Practically all of the copper relics found are wrought, not cast. The art of casting appears to have been unknown, although the fact that the Indians knew that copper would melt is mentioned by DeChamplain, the founder of the city of Quebec, in 1610. If European civilization had not brought to America this knowledge of casting copper and its alloys, it undoubtedly would have been discovered later, as the art of manufacturing bronze was known at this time in Mexico and Peru. Many archaeologists hold that Asia is the home of the origin of bronze and by the time of the introduction of copper into Europe the properties that were imparted to it by the alloying with tin were well known.

The Hebrew Scriptures throw but little light on the subject of the metals. The word translated in our

*Presented at the annual meeting of the American Brass Founders' Association.

version—brass, a compound of copper and zinc, would be more properly translated bronze, as for instance, where Moses is commanded to cast five sockets of brass for the pillars to carry the hangings at the door at the tabernacle.

Tin.

Though gold and silver were discovered before copper, yet copper seems to have been the first metal which became of real importance to man, probably on account of its wide occurrence and the ease with which its ores are smelted. Tin also attracted early notice on account of the great heaviness of its ores. When metals were scarce it would sometimes happen, naturally, that some tin would be added to copper, or vice versa, and it would then be found that the properties of the alloy were quite different from the original metal. No relics of tin have been found alone and very few of copper. The few exceptions possibly indicate temporary lack of either metal.

Casting of Ancient Bronze.

Bronze, as already stated, is an alloy of copper and tin and therefore distinct from brass, which is an alloy of copper and zinc. Many varieties of bronze, or as it is now more commonly called, gun metal, are in use at the present day; and one remarkable feature of bronze is that the admixture with copper of the much softer metal, tin, in varying proportions, produces an alloy in most, if not all, cases, harder than the original copper. When the tin is in high percentage, as in the metal used in the speculae of telescopes, the resulting alloy is so much harder, that, a priori, such a result of the mixture of two soft metals would have been thought impossible. The addition of tin, while increasing the hardness of copper, also renders it more fusible. In small proportions it but little affects the color of copper and it is difficult to recognize its presence by the physical characteristics of the copper except from that of increased hardness. It is on this account that many articles of so-called tempered copper have deceived investigators. In nearly every case the hardness or temper is found on analysis to be due to tin combined with the small amount of impurities, such as iron, etc., which were nearly always present in the ores from which the copper was derived. The recognition of this fact may save some investigator from wasting his time and money looking for a "lost art," a search which may properly be classed with that for perpetual motion.

Bronze Mixtures.

Both ancient and modern practice indicate that the most serviceable bronze is a mixture of nine parts of copper with one part of tin, which composition produces a hard though not brittle alloy. Variation from this formula may be due to several causes, some of which are as follows:

1. Temporary lack of one or the other constituent metal.
2. Separation of tin, called liquation, in the lower part of the casting, causing what are commonly known as tin spots.
3. The loss of tin through oxidation in repeated remelting.

When it was once discovered that copper was fusible by heat it would naturally be but a short time before the more metallic appearing ores would be reduced to metal. This process was equally applicable to tin, and the bronze could either have been formed by the direct admixture of the copper and tin or the smelting together of the ores containing these metals.

The evidence available makes it most probable that the knowledge of metal is one of the great discoveries which Europe owes to the east and places the original source of bronze, like that of the Aryan family, in an Asiatic rather than a European center. This explains why in all countries of Europe where bronze relics have been found, their composition is as nearly identical as the imperfect metallurgy would permit. The similarity almost identical, of the design of the various implements found in so-called ancient bronze founders' hoards, points also to the fact that the people making these implements emanated from the same region and carried with them the art of casting bronze as they migrated from one country to another.

Definition of Bronzes.

It may be well to consider the definition of the various bronzes as an aid to a better understanding of what follows. A true bronze is composed of copper and tin in which any other metals present have been introduced by accident, as for instance, through impure copper. True bronzes are the oldest of the several types. True lead bronzes, that is, those in which the lead was introduced advisedly, generally contain very little iron or other accidental metals. In some cases the lead ran over 20 per cent. It is difficult to tell whether a sample of bronze had lead added intentionally or not, on account of the fact that some crude copper of this period has been found containing 20 per cent of lead. Lead bronzes belong to the Mediterranean countries and are especially characteristic of Egypt, Republican Rome and Etruria. Zinc bronzes are later than lead bronzes and appear to be entirely of Roman origin. Brass was made in Europe as early as the third century, B. C., by adding Smithsonite*, or flue sublimate from furnaces in which ores containing zinc were smelted, to melted copper, with a view of giving the latter a yellow color. It was, however, about the time of Caesar that the use of brass became general.

Early Practice.

Prof. Sullivan** arrives at the following among other conclusions, from the chemical facts at his command:

1. The northern nations in ancient times used only true bronzes of greater or less purity, according to the kind of ores used.
2. Many of those bronzes contain small quantities of lead, zinc, nickel, iron and silver, derived from the copper from which the bronze was made.
3. Though some bronzes may have been produced directly by melting a mixture of copper and tin ores, the usual mode of making them was by treating fused crude copper with tin stone. In later times bronze was made by mixing the two metals together.
4. Bronzes were not formed of variable proportions of copper. The makers aimed at the production of definite alloys by mixing the ingredients according to empiric formulae. There were four types of true bronzes, according to the relative proportions of tin and copper.

The predominant alloy used by all the northern nations of Europe was gun metal, containing from 9 to 12 per cent of tin, the typical alloy being composed of 11 per cent of tin and 89 per cent of copper.

5. The great variation in composition of many bronzes which has led to the belief that the ancient bronzesmiths did not aim at the production of alloys of a definite composition, that is, mixed the ingredients in an arbitrary manner, arises from the remelting of the original bronze by which a portion of the tin was oxi-

*The carbonate and silicate of zinc were formally called calamine, but that name is now confined to the silicate, the carbonate being called Smithsonite.

**Introduction to Curry's "Manners and Customs of the Ancient Irish."

dized out each time the metal was melted.

6. Copper appears to have been always made from sulphurets, including such complex minerals as gray copper. This implies a considerable amount of progress in mining and metallurgy.

7. The tin ore used was chiefly stream tin, and was obtained in at least four districts of Europe, Cornwall, the Erzgebirge of Saxony and Bohemia, the present Vaulry in France, and Western Austrias and Galacia in Spain.

8. The copper of the ancient bronzes seems to have been smelted in many different localities.

9. There is no evidence of the existence in Europe of what is called a "copper age." There is every reason to believe that the Aryans knew how to make bronze before their advent into Europe.

10. The bronzes of the early Greeks were true bronzes; those of the Egyptians and early Romans were lead bronzes, that is, contained lead as a normal constituent. The Romans appear to have learned the use of lead from the Etruscans, probably a semitic people.

11. We have no analyses of Phoenician bronzes to enable us to positively assert that they were lead bronzes; but as the Phoenicians received all their civilization, letters and arts from Egypt, and had continual intercourse with that country, it is scarcely probable that the cheaper and more fusible lead bronzes should be unknown to them, especially as a kindred people, the Etruscans, knew the use of lead.

12. The general use of lead bronzes in the Mediterranean countries, from at least 500 B. C., except in Greece, which appears to have got its tin from Central Asia, renders it highly improbable that the nations of northern Europe received, at least to any great extent, their bronze arms, tools, etc., from the south of Europe. The presence of lead in some bronze musical instruments and ornaments, points to the southern origin of those articles, at least southern influence in their manufacture and consequently in their use.

13. Towards the end of the Roman republic, zinc bronzes came into use in Rome, and are to be found in all the places occupied by them in Gaul, Britain and Germany. The pure bronzes of northern Europe are not, therefore, of Roman origin.

14. The bronze weapons and tools found in the Baltic provinces are very rich in zinc, a fact which Prof. Göbel thinks, proves that the material at least is of Roman origin. The copper which was used by the bronze founders of olden times, appears to have been smelted from the ore and run in a shallow concave mold open at the top, in which the metal assumed the form of a circular cake, convex below and flat above, but before becoming sufficiently cold to be quite set into tough metal, these cakes seem as a rule to have been disturbed and broken up into numerous pieces, better adapted for remelting than the whole cakes would have been. As to the method of melting the metal but little is known. It seems probable, however, that the crucibles employed must have been vessels of burnt clay provided with handles for moving them; while for pouring out the metal small ladles of earthenware may have been used. In Switzerland, small crucibles of ladle-like form have been found, in some cases with lumps of bronze still in them.

Methods of Casting.

The methods of casting may be classed as follows:

1. In a single mold formed of loam, sand, stone or metal, the upper surface of the casting showing the flat surface of the molten metal which was left open to the air. The pattern of the model was, in the case of sand or loam castings, pressed into the mold as described later.

2. In a double mold either of stone or metal which must of necessity be in pieces or halves and show the junction line on the casting.

3. In a double mold of fine sand by first making a model of the object in wood or some other hard substance and pressing it on the fine sand so as to obtain a corresponding hollow. The sand was retained by two frames or boxes to keep it in place when the upper half of the mold was lifted off the pattern. This method would show the junction line, the same as the previous one. The advantage of this method is that the sand can be easily worked into the required form and wooden models are more easily made than hollow molds of stone or metal.

4. In a solid or wax mold. In this case as in the former, a wax or wax coated model was made and enclosed in prepared earth made of clayish soil mixed probably with cow dung or some other inflammable substance in order that when subjected to heat it might become porous. The mold was then warmed and the wax ran out of the hole through which the metal was to be poured in. This was the commonest method used during the bronze age. It required few instruments and did not, like methods two and three, show a line of junction, which was a great advantage, because in the absence of steel the projecting ridge thus produced was very difficult to remove, especially when the objects were ornamented.

Early Knowlege of Metallurgy.

Some evidences of crude metallurgical knowledge are interesting. Besides the orifice through which the bronze was poured into the mold, it was necessary to have one or more holes through which air might escape. The first being funnel-shaped was easily removed, but the latter were frequently beaten over, for without steel it was impossible to cut them off. Indeed the smiths of the bronze age seem to have been unable to pierce the bronze and the holes for rivets, as in the swords, etc., were cast and not pierced. Even the ornamentation in circles, spirals, etc., on the bronze objects are all cast. Moreover, it is evident that the wax process must have been used, for the line of junction does not show on the ornamented objects where it could not have been obliterated, had it been present. Soldering seems to have been unknown in the bronze age, for the bronze vessels were always riveted together; but the art of burning bronze to bronze was certainly known, many instances of it having been found. Cores seem to have been used in some castings, and appear to have been made of sand and clay or in a few cases of metal. Relics have been found with clay cores in them, burned almost as hard as a brick.

Bronze Instruments.

The process of casting bronze instruments in loam, clay or sand must have been much the same as that in use at the present day; but it was rarely that the mold consisted of more or less than two pieces.

It is not uncommon to find castings which show that the two halves of the mold or of the flask had slipped sideways, so that they were not in the proper position when the casting was made. Anyone familiar with the molding machine practice of today must see from the above statement a great similiarity between the molding practice of ancient and modern times. It certainly verifies the statement that the foundry yet furnishes plenty of opportunity for the chemical engineer.

FOUNDRY WAREHOUSE METHODS*

A Novel and Practical System for Maintaining Records of Stock and Shipments—Arrangement of Floors

BY F. C. EVERITT

WITH POSSIBLY a few exceptions, probably no one subject which we might classify under the heading of "System" would be subjected to a wider range of variation, due to the local conditions of various plants and their line of goods manufactured, than the subject of "Foundry Warehouse Methods." To carefully consider and present any one plan or method that might be generally applied for the proper and profitable handling of goods and that the majority of manufacturers would not raise objections to if applied to their particular case, would be very exceptional. Not that they would be averse to the application of such methods; but because the conditions are so varied that radical changes in any set method when applied to different plants are absolutely necessary. It is very true that the local conditions can be changed to conform to the method in question, but this is not always advisable as it might involve a greater expense and more confusion than could be overcome in a long time, whereas, a few changes in which other methods have been and are being applied by firms conducting well organized warehouses.

Points to Consider Before Applying the System.

For convenience we will consider a plant operating a foundry, a mounting or finishing department and a warehouse. We will assume also that the plant has been in operation for a given period. This will provide us with some knowledge as to the demand for the different articles manufactured. We may then decide what points are most important for careful consideration before applying our method.

(a) Method of storing the finished stock in the warehouse. Its location and records.

(b) Method of ordering completed goods for warehouse stock.

(c) Means of ascertaining quantities sold in the past in order to judge what quantities to order for stock, preventing an overstock and guarding against the article becoming obsolete before stock is exhausted.

floors into sections or bins as the case may suggest, the floors, sections and bins being numbered in the order named, as, floor No. 1, section 25, bin 50. We can then very readily refer to the location in a simple manner (location 1, 25, 50). With this part of our plan established we may prepare the warehouse office "stock and order book," a sample sheet of which is shown, Fig. 1. On these sheets, bound in loose leaf binders, we will enter the name of the article and its size, maximum and minimum quantities to be carried in stock and its location, one sheet or page being used for a single article. As the orders are received in the general office and recorded, copies are sent to the warehouse office and entered immediately on the stock order book in the columns under the heading "orders." The stock on hand having been previously entered in the "stock" column, we readily note that we have 300 on hand and can ship at once. A warehouse memo slip, bearing the order number, customer's name, article and its location, is handed to the man in charge of the

SHEET NO. .....
TOTAL SHIPPED 190 7 ..... 2000 .....
" " 190 .....
" " 190 .....
" " 19 .....

ARTICLE.... Nameless Article Size #1 ....
MAX. 800 MIN. 250 LOCATION OF STOCK ..... FLOOR ..... BIN .....

ORDERS				SHIPPED		REQUISITION FOR STOCK			RECEIVED		APPLIED ON ORDERS			STOCK		
DATE	ORDER NO.	CUSTOMER	QUAN.	DATE	QUAN.	DATE	REQ'N. NO.	QUAN.	DATE	QUAN.	DATE	ORDER NO.	QUAN.	DATE	REQUIRED	ON HAND
4-1-08	2561	Jones + Co	100	4-2-08	100									4-1-08	100	300
4-14-08	2843	Smith + Son	125	4-14-08	125	4-2-08	480	500	4-3-08	25		Stock		4-2-08		200
									4-4-08	50		"		4-4-08		
4-16-08	3001	Brown + Co	200						4-8-08	200		"		4-8-08		
									4-13-08	225		"		4-13-08		
														4-14-08	125	
														4-15-08		575
														4-16-08	200	

The Foundry

FIG. 1—SHEET FROM THE STOCK AND ORDER BOOK

the methods to be adopted would give entire satisfaction with little expense.

In submitting any method, it will be necessary to confine ourselves to those plants which conduct a warehouse in connection with a foundry and mounting or finishing departments, and then only as a suggestion that may be the means of provoking discussion and bring to the attention of our members the success with

(d) Method of handling orders for shipment which might be held for shipping instructions. Location of these prepared orders.

(e) The storage and handling of castings before mounting and the method of ordering on the foundry.

Arrangement of Floors.

With the first item (a) it will be necessary, according to the construction of the warehouse, to carefully and systematically arrange the different

stock to prepare the goods for shipment, after which he reports to the warehouse office, goods ready to ship. When shipped, the ticket or original order is again referred to the stock order clerk, who enters the shipment in the "Shipped" columns, and the balance on hand is computed and entered in the "stock" column.

(b) As the stock falls below the minimum quantity, a requisition is at once issued on the mounting or finishing department. As the goods are

*Presented at the annual meeting of the American Foundrymen's Association.

received from this department, a daily report is made by the warehouse man to the stock order clerk, who makes the proper entries in the "received" column, the quantity in each case being carried to the "stock" column and showing a total.

Application of Record Information.

(c) If this method be continued for a period of one or two years it is very plain to see that we will have a volume of valuable information that can be applied to good advantage. We are able to tell at all times the number of orders on hand for any one article, requisitions issued for goods to go in stock, quantities received, stock on hand and the quantities sold for the above mentioned period, the last item of which will enable us to intelligently fix the maximum and to know what quantities to order for stock to meet future demand for a six months' stock, we must endeavor to keep the stock within salable quantities and the conclusion is simply a matter of "good judgment" and we decide that a six months' stock order will be 700 instead of 1,000, which will, according to our best judgment, prevent an over stock and keep it within the danger line of decreased business.

What conclusions are we now able to draw from the above information? Simply this, that we have data at hand which will serve as a guide in preventing an undesirable over stock that so often results in an accumulation of goods that really become dead and obsolete. We cannot say, however, that the method would entirely obliterate this undesirability, but it would tend to minimize these possibilities which would be a big step in the right direction.

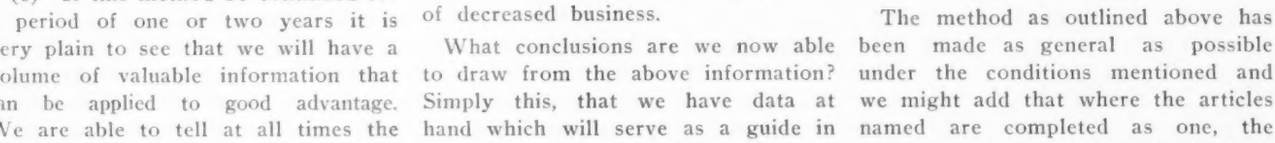


FIG. 2—RECORD OF ORDERS AND SHIPMENTS

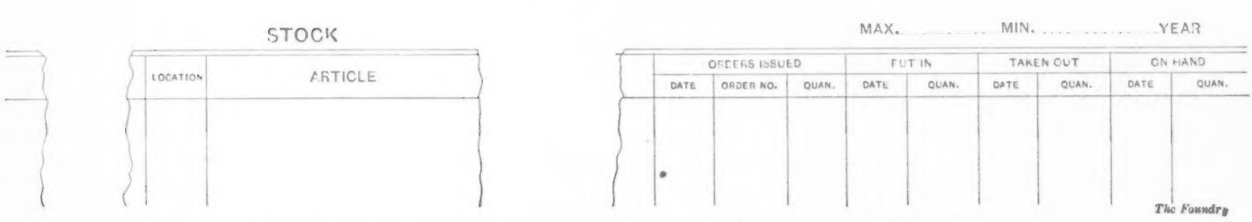


FIG. 3—STOCK RECORD OF CASTINGS AND ORDERS ISSUED ON THE FOUNDRY

mands. In placing these requisitions for stock on the departments we must not lose sight of one important fact. Do we know or are we in any position to tell, with the above information at hand, whether the demand for any one article will be as great during the year to come as was the case with the year just past? We do not, for while the outlook for the next year's business may be unusually favorable, we may have discovered by referring to our records of two or three years that size No. 1 of a given article sold during one year at the rate of 2,000 and size No. 2 sold at the rate of 500. Another year has shown that No. 1 decreased and No. 2 increased in sales, which might have again reversed during a third year. If we have placed our maximum during the last year at 2,000 and wish to place a requisition on the mounting or finishing department for stock on hand, we will find that the stock is not taken and the entries and balances made when goods are reported, we will have a false statement of stock on hand as well as being in a position to overlook these prepared orders when taking inventory from the stock books at the end of the year.

Stock Orders.

(d) Returning again to our stock order book, we must endeavor to avoid all confusion in order that our records be simple and accurate. With this in mind we will take for example goods reported for shipment and held pending shipping instructions. The goods must be placed in a located section of the warehouse nearest the shipping floor, this location having been noted on the warehouse memo before being reported to the stock order clerk. We will note in the "order" column of the sample sheet an order for Brown & Co., 200 articles and in the "stock" column required, 200 with no balance made and no entry having been made of shipment. This will show at a glance that the goods on this order are being held and the memo on file will give the location of the order ready for shipment. If this precaution is not taken and the entries and balances made when goods are reported, we will have a false statement of stock on hand as well as being in a position to overlook these prepared orders when taking inventory from the stock books at the end of the year.

Second Method.

The method as outlined above has been made as general as possible under the conditions mentioned and we might add that where the articles named are completed as one, the method is simple and easily handled. However, if the articles are composed of many parts, any one of which might form a part of several other articles, it might be wise to rely on a second method briefly outlined below. This method can be applied to good advantage in the departments where the many parts are used to make the assembled article and in conjunction with the warehouse stock order book.

While this record, Fig. 2, may seem a duplication of the warehouse record and apparently call for unnecessary clerical work, it serves to a very great advantage in the department inasmuch as it shows at all times an accurate record of the requisitions on file for goods to be made up for warehouse stock and orders from other departments that may be in the plant. The two methods worked together would undoubtedly be subject to many changes due entirely to the size of the plant, the number of departments and the general disposition of the goods manufactured.

Records of Orders, Shipments and Stock.

(e) The forms shown, Fig 2 and Fig. 3, are intended to be used in the same department but are to be han-

dled entirely independent of one another, Fig. 2 being a record of orders and shipments and Fig. 3 a stock record of castings and a record of orders issued on the foundry. This form is simple and needs little explanation. The method of locating the stock would, of course, be the same as outlined for the warehouse and a single sheet or page in this book used for each casting. Ample space is allowed for the name and description of the part, as well as a rough sketch if desired. The maximum and minimum quantities to be carried in stock can be ascertained precisely as in the first method. The columns for orders issued on the foundry, date and quantities received, taken out and on hand are simple and need no further explanation.

The two methods here outlined worked in conjunction or separately may fulfill all requirements, but will without a doubt be subject to the changes found necessary in various plants.

SPECIFICATIONS FOR CAST IRON TO BE MACHINED.*

By H. E. Diller

The machine shop which buys its castings generally takes what it gets—soft, medium, or hard—and usually has no redress, unless the satisfaction of constant complaint and frequent change of manufacturer. General complaint seems to be the only remedy the machine shop which purchases its castings feels willing or able to make. Although many companies specify that out of each heat, one or more test bars shall be cast and tested, this is usually done to insure strength but not softness in the iron. There are many castings on which considerable machine work is done and for which the strength of any soft iron is sufficient. For this class of castings, I would propose a specification which need cover only two points as to physical qualities and two points in the composition of the iron, and still insure a satisfactory casting.

Specifications for Ordinary Castings.

First, that the castings be free from blow and shrink holes. This is the only qualification the majority of castings require to insure sufficient strength.

Second, that the surface of the casting be smooth and reasonably free from sand. This is a rather indefinite statement, but by establishing a standard of work between the individual buyer and producer, the specification can be made to mean something. Then the two specifications which I would suggest for the composition of the iron, are upper limits for the amount of combined carbon and the amount of sulphur.

Determination of Combined Carbon.

It would also be advisable to have a standard method for determining the amount of combined carbon. By using the color method and having the same standard, there is no reason why there should be any dispute as to whether the castings were coming up to requirements.

With such specifications, the foundry could be made to stand the extra expense of machining hard iron, and the foundry which could make regularly soft castings could command a higher price for them. When it is considered that the extra cost of machining a very hard casting sometimes equals the cost of the casting, it seems fair that the man who makes the hard casting should have some handicap in competing with the foundryman who turns out a uniform grade of iron.

As to the reliability of the combined carbon as an indicator of the hardness of iron, I was convinced by nearly a year of daily tests on a drill press and color carbon tests. These tests usually agreed closely, but when they did not, it was invariably due to some irregularity in the way the drill was sharpened or a little less power in the drill press.

It might be advisable to put an upper limit on the amount of phosphorus, but this limit would be so high as to be practically no limit—say 1 per cent.

There are so many variables enter-

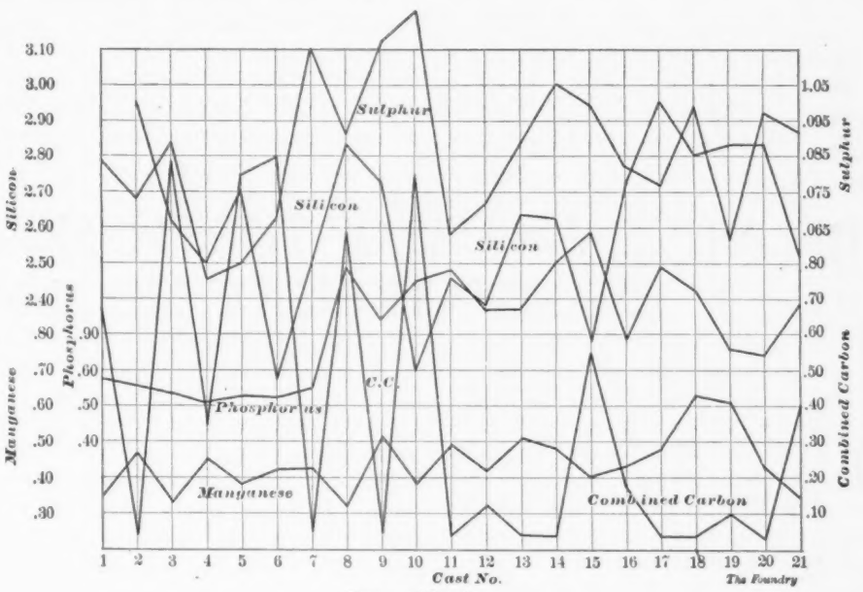


Chart No. 1

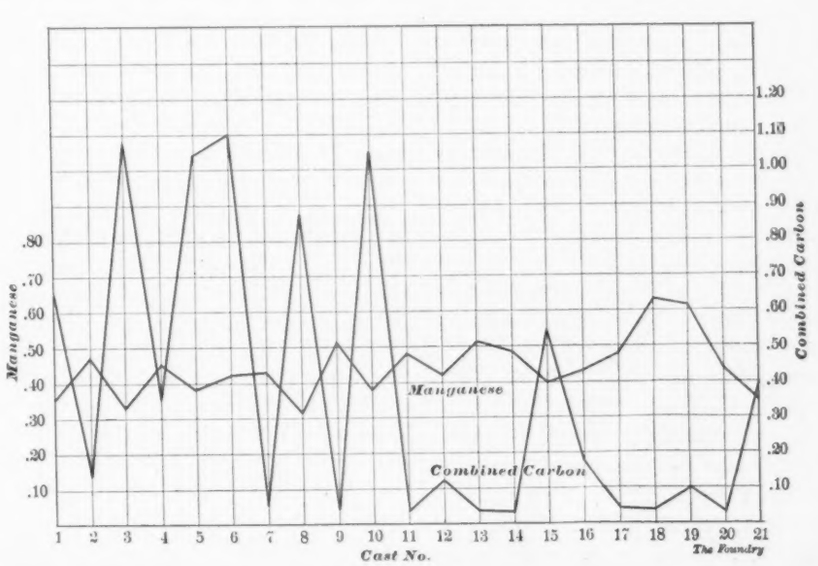


Chart No. 2

* Presented at the annual meeting of the American Foundrymen's Association.

ing into the making and composition of a casting that to me it seems the only and simplest way of specifying the quality of the iron for machining is to require it to be free from physical defects and to set a limit on the amount of combined carbon it may contain.

Effect of Manganese.

The accompanying charts give a graphical illustration of the effect of manganese at the critical point on a fairly high silicon iron, cast in a heavy section to avoid the effects of the mold on the cooling of the iron.

Chart No. 2 gives only the manganese and carbon curves.

On chart No. 1 we see for the eighth cast, with the silicon nearly the highest of any cast—2.83 per cent—and the sulphur medium—0.091 per cent—the combined carbon was high—0.86 per cent—while in the second cast in which the silicon and sulphur are about the same as in the eighth cast—2.94 per cent and 0.073 per cent—the combined carbon is only 0.04 per cent. Again taking the ninth cast with sulphur much higher—0.117 per cent and silicon a little lower—2.73 per cent—which should make a harder iron than that in the eighth cast, we find only 0.04 per cent of carbon. In the hard iron, the manganese is 0.32 per cent, while in the soft iron it is 0.47 per cent and 0.5 per cent respectively.

From this chart it would seem clear that silicon and sulphur contents will by no means guarantee a soft casting, even in a heavy section, if other conditions are not right; but that a determination of the combined carbon will tell very quickly if the iron is hard.

RELATIVE VALUES OF THE PHYSICAL AND CHEMICAL EXAMINATIONS OF MOLDING SANDS*

BY HEINRICH RIES

IT IS probably well known to all who have looked into the subject, the successful use of sand for casting purposes whether for molds or cores depends on certain physical qualities, such as bonding power, permeability, porosity, refractoriness and durability under use, all of which should be naturally developed to the necessary degree, and few of which are usually increased by artificial means, except the cohesiveness, which is often increased in core sands and sands for steel castings by the addition of binders.

At the present time the suitability of a foundry sand is most often determined by a practical test, but few foundries giving any attention to a laboratory examination. Indeed there seems to be doubt in the minds of many, whether a laboratory test is of value. At some works, sieve tests are made, at others a chemical analysis, and in rare cases both are tried. Only a very small number of foundries buy their sands according to specifications, but a large number purchase them on the recommendation of the foundry foreman. As a result of this we sometimes find the same sand being tried by two different foundries for exactly the same kind of castings, and the one reporting it to be of very satisfactory quality while the other turns it down as nearly worthless.

Standard Tests.

With such a rarity of application of laboratory methods of testing it is therefore not surprising that no attempts have been made, so far as the writer is aware, to establish any standards to which sands should conform, much as these are to be desired. Such tests to be satisfactory should of course determine the degree of development of the several important physical characteristics in the sand, and if necessary look into the chemical composition. It may be stated here that the aim of the present paper is largely to call attention to the fact that the chemical analysis is of little value in most cases.

Cohesiveness.

The cohesiveness or bonding power of the moist sand is an extremely important property, for without this the material does not hold up properly in the mold. It is dependent no doubt on the amount and character of the clayey matter which the sand contains, and also on the coarseness of the sand grains. An increase in the amount of clay and a decrease in the size of the sand grains tends to increase the bonding qualities.

No good test for determining the bonding qualities of the sand has thus far been devised. The mechanical analysis, which shows us the amount of sandy and clayey matter present in the sand will, it is true, throw some light on this point, and may be used as an approximate index of its cohesiveness. Thus, for example, of the two sands, whose mechanical analyses are given below, No. 1 is coarse grained and does not cohere even when moist, while No. 2, showing a considerably higher percentage of fine sand and clay, has good bonding qualities.

Size mesh.	No. 1. Per cent retained.	No. 2. Per cent retained.
20	11.13	0.09
40	12.08	0.45
60	21.93	1.51
80	4.33	0.31
100	19.16	0.74
250	30.01	66.79
Clay	1.35	30.08

No. 1. Core sand, Rochester, Mich.

No. II. Stove plate sand, Conneaut, O.

It has been suggested that the cohesiveness be tested by the tensile strength, but the results do not in all cases appear to be satisfactory. Experiments made by Parmelee** to determine this point showed that the tensile strength varied with the tapping which the sand received and that there appears to be no direct relation between the average fineness and the tensile strength. It was concluded from this that the tensile strength did not stand in any direct relation to the bonding power.

Chemical Analysis.

Turning to the chemical analysis we find at once that there is no relation between the bonding power, and plasticity and the percentage of alumina as is sometimes claimed. Two analyses will serve to illustrate this point:

	No. 1. Per cent.	No. 2. Per cent.
Silica	66.12	70.24
Alumina	16.54	16.62
Ferric oxide	4.46	3.94
Lime	0.40	0.08
Magnesia	0.22	0.09
Potash	2.67	1.41
Soda	0.35	0.74
Titanic oxide	0.14	0.46
Water	4.90	4.16
Moisture	4.15	2.4

No. 1 is a coarse grained gravelly

*Presented at the annual meeting of the American Brass Founders' Association.

**Geol. Surv., Ann. Rep., 1904.

sand, while No. II is a fairly plastic loam.

Another Analysis.

Still another example may be given. Of the two following analyses No. 1 is a well known molding sand used for stove plate and brass work, and much employed throughout the eastern and central states, and while No. II is a sandy brick clay of sufficient plasticity and cohesiveness to be used for brick manufacture:

	No. 1. Per cent.	No. 2. Per cent.
Silica	79.36	90.00
Alumina	9.36	4.5
Ferric oxide	3.18	1.44
Lime	0.44	0.10
Magnesia	0.27	0.10
Potash	2.19	trace
Soda	1.54	trace
Titanic oxide	0.34	0.70
Water	2.02	3.04
Moisture	0.74	....
	99.46	99.98

Judging from the analyses, some might conclude that No. 1 is more plastic because of its lower silica and higher alumina contents, whereas as mentioned above the reverse is true.

Refractoriness.

Foundry sands should be sufficiently refractory to prevent the pores closing up by fusion when the material is exposed to the heat of the molten metal. Were this to occur there would be no openings for the gas to escape. Few tests have, to the writer's knowledge, been made to determine this point, but it would seem that a good method might consist of exposing pressed cubes of the molding sand to a temperature equal to that which they are to be subjected to in casting. The degree to which they become fused or vitrified could then be determined.

Two sands showing the same quantity of fusible impurities will not necessarily be of equal refractoriness, for much depends on the texture of the material, the coarser one showing the greater refractoriness, other things being equal. In every sand we can roughly separate the grains into two groups, the silicious or refractory and the clayey or non-refractory. If the sand contain only the former it is apt to be very refractory (sand for steel castings), while if any clayish matter be present it will tend to flux with the silica grains if heated high enough, this fluxing action being the more intense the finer the silica particles.

Since a coarse-grained sand is likely to be more refractory, and a clayey or very fine-grained one less refractory some inferences may be drawn from the mechanical analysis.

The chemical analysis yields us information on this point only within very wide limits, permitting us to conclude that sand with a large quantity of fluxing impurities would not stand as much heat as a steel casting sand with, say 98 per cent silica. Among most sands it is difficult, however, to make any predictions what their fire resisting qualities are likely to be if we have only the chemical composition to guide us, because texture plays such an important part.

Texture.

This property is of much importance, for as has already been pointed out, it may affect the cohesiveness of the sand, and also the refractoriness. But, more than this, it stands in close relation to its permeability, and determines also to a large degree the grade of metal work that can be cast in it.

Texture and Structure.

The chemical analysis of a sand throws little light on its texture and structure, as an examination of any series of tests will show, but a few examples will serve to emphasize this point.

Thus in the four sets of chemical and mechanical analyses given below, Nos. I and II agree closely in their chemical composition, but differ markedly in their texture, and the disagreement of III and IV is still more marked, although their chemical analyses are very much alike.

Chemical Analyses.

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.	No. 4. Per cent.
Silica	79.36	79.38	84.40	85.04
Alumina	9.36	9.38	7.50	5.90
Ferric oxide	3.18	3.98	2.52	3.18
Lime	0.44	1.40	0.06	0.06
Magnesia	0.27	0.54	0.21	0.14
Potash	2.19	1.80	1.29	1.65
Soda	1.54	1.04	0.65	0.83
Titanic oxide	0.34	0.44	0.44	0.78
Water	2.02	2.50	1.49	1.57
Moisture	0.74	0.80	1.76	1.11

Mechanical Analyses.

Size. mesh.	Per cent retained 1.	2.	3.	4.
20	0.26	0.06	0.09	0.19
40	0.51	0.12	0.41	0.19
60	2.53	0.32	2.21	0.39
80	0.99	0.16	2.67	0.19
100	4.19	0.83	17.37	0.98
250	79.85	23.38	58.20	81.92
Clay	11.24	24.73	19.02	15.97

No. I, Albany sand used for stove plate work, No. II, stove plate sand, Newport, Ky., No. III, sand for general work, Petersburg, Va., No. IV, sand for general work, Fredericksburg, Va.

Permeability and Porosity.

The permeability of a sand may be defined as the property which it possesses of allowing liquids or gases to filter through it. It depends therefor on the size of the pores. The porosity can be defined as the volume of pore space between the grain. These two properties are therefore different and should not be confused. Two sands might have exactly the same percentage of pore space, but differ in their permeability, and the latter would be greatest in the one containing the largest pores.

Again, a sand might have a large total pore space, but owing to the smallness of the pores its permeability for gases and liquids would be low. Of the two physical properties mentioned above the permeability is by far the more important, but so far as the writer is aware it is never tested, because to do so satisfactorily requires special apparatus. The foundryman sometimes attempts an approximate determination by taking some of the sand between his hands and blowing through it. In the laboratory it could be tested by determining the time required for a given volume of air, to pass through a given volume of sand, under a given pressure.*

Such a test should, in the writer's opinion, be made on both the dry sand and also on the moist sand tamped at the same pressure as it would be in the mold.

The texture determination may give us some information regarding the permeability as the finer grained a sand and the more clayey its character, the smaller its pores and the lower its permeability.

Relation Between Texture and Permeability.

As an example of the relation between texture and permeability we may take the two following sands, whose analyses are given herewith:

Size mesh.	—Per cent retained—	
20	0.08	0.27
40	0.20	0.54
60	0.17	1.21
80	....	0.32
100	0.14	1.21
250	87.56	69.46
Clay, per cent porosity	45.90	38.70

No. I is the more porous, and permeable of the two, and allows the gases to escape more readily. This higher porosity is shown above, and is influenced evidently by the lower clay content.

It is probably reasonable to assume that there is a general but not very close relation between the porosity, texture, and permeability, and we should be justified in stating that of two sands having the same texture, the one with the greater porosity is probably the more permeable of the two. The measurement of permeability is a somewhat difficult operation and requires special apparatus, but the determination of porosity is by no

*King, U. S. Geol. Surv. 19th Ann. Rept., pt. 11, p. 209-215.

means hard to make, and gives us, when considered with the texture, an approximate gage of the permeability of the sand.

Life of Foundry Sands.

Practically all molding sands lose some of their desirable qualities after being exposed to the heat of the molten metal, and become "dead." A dead sand has had much or all of its cohesion destroyed, and its texture altered, as well as having changed slightly in its chemical composition.

In casting it is the layer next to the metal which is most affected, and the thickness of this layer depends on the size of the casting and temperature of the same. On removing the casting it is impracticable to separate all of this burned sand from the unburned and moreover there is no sharp line of division between the two, so much of it gets mixed up with the sand which did not become burned. Since, however, this dead sand has lost much of its bonding power, a small amount of fresh sand has to be added from time to time.

In order to consider a method of testing the life, one must consider what factors influence it. The deadness is no doubt due to several causes, such as dehydration of the clayish particles, resulting in the destruction of their plastic qualities, or the agglomeration of particles by fusion, thus increasing the coarseness and making it less plastic.

While a practical test is perhaps the best thus far known for determining the life of the sand, it seems as if the chemical analysis might give us a clue, assuming the loss in cohesiveness to be due partly or even largely to the dehydration of the clay. A clayey sand would show more chemically combined water than a silicious one. The degree of agglomeration that occurs when heated should also be observed.

Tests of Used Sand.

In this connection the two sets of analyses given below are not without interest. No. 1 is an unused molding sand from Richmond, Va. It is much used for general work in the local foundries and bears an excellent reputation. No. II is some of the "dead" sand taken from the layer next to the metal.

Mechanical Analysis.

Size mesh.	—Per cent retained— No. 1.	No. 2.
20	1.51	5.34
40	1.26	14.73
60	1.27	10.41
80	0.56	1.28
100	6.27	14.61
250	71.69	59.37
Clay	16.52	3.52

Chemical Analysis.

	No. 1. Per cent.	No.2. Per cent.
Silica	83.49	82.32
Alumina	7.25	7.80
Ferric oxide	4.71	3.98
Lime	0.36	0.54
Magnesia	0.35	0.41
Potash	1.30	1.64
Soda	0.41	0.81
Titanic oxide	0.30	0.22
Water	1.66	0.19
Ferrous oxide	....	2.38
Total	99.86	100.28

Comparison of these two sets of analyses indicates that there is a decided increase in the coarseness of the dead sand, due to a fusing together of the particles. The chemical analysis shows little difference between the fresh and the used sand except in the case of the water which has been driven off, and there is also an increase in the iron, some having been absorbed from the metal. Much of it is moreover in the ferrous condition.

Conclusions.

It seems to the writer that the evidence which has been given points somewhat forcibly to the fact that the chemical analysis is to be but little relied upon in judging the qualities of a molding sand, and that the physical tests are far more important.

In order to consider the question from as many standpoints as possible, we may inquire whether there is any relation between the chemical composition and the use to which the sand is to be put. Do brass sands, for example, show any chemical composition which distinguishes them from sands to be used for iron castings? I believe that here again the evidence is distinctly in the negative:

	No. I. Per cent.	No. II. Per cent.	No. III. Per cent.	No. IV. Per cent.	No. V. Per cent.	No. VI. Per cent.	No. VII. Per cent.
Silica	71.60	86.80	57.63	79.36	79.81	81.50	82.21
Alumina	11.49	3.05	10.03	9.36	10.00	9.88	9.48
Ferric oxide	7.81	5.32	0.88	3.18	4.44	3.14	4.25
Lime	0.65	0.15	11.16	0.44	0.70	0.65	1.04
Magnesia	0.95	0.65	5.63	0.27	0.88	1.04	0.32
Potash	1.42	0.83	....	2.19	....	....	0.05
Soda	1.27	0.04	....	1.54	....	....	0.09
Titanic oxide	....	....	....	0.34	....	....	....
Loss on ignition	4.00	3.25	14.66	2.02	2.89	3.00	2.64
Moisture	....	....	....	0.74	....	....	....

In the table given above Nos. I and II are both brass sands, but are quite dissimilar in their silica and alumina contents. No. III is also classed as a brass sand, but bears no resemblance chemically to Nos. I and II. Nos. IV and V are not dissimilar, and yet the former is a stove plate sand while the latter is used for making heavy castings. Of course there are cases where two sands used for the same class of work are of similar composition as Nos. VI and VII.

To sum up, then, regarding the chemical analysis, it would seem to the writer that it gives us little or no information regarding the bonding power, texture, permeability or use of the sand, the only case in which it is of value being in the selection of a highly silicious sand for certain work, such as steel casting.

A ONE-PART UNIT FLEXIBLE SHAFT.

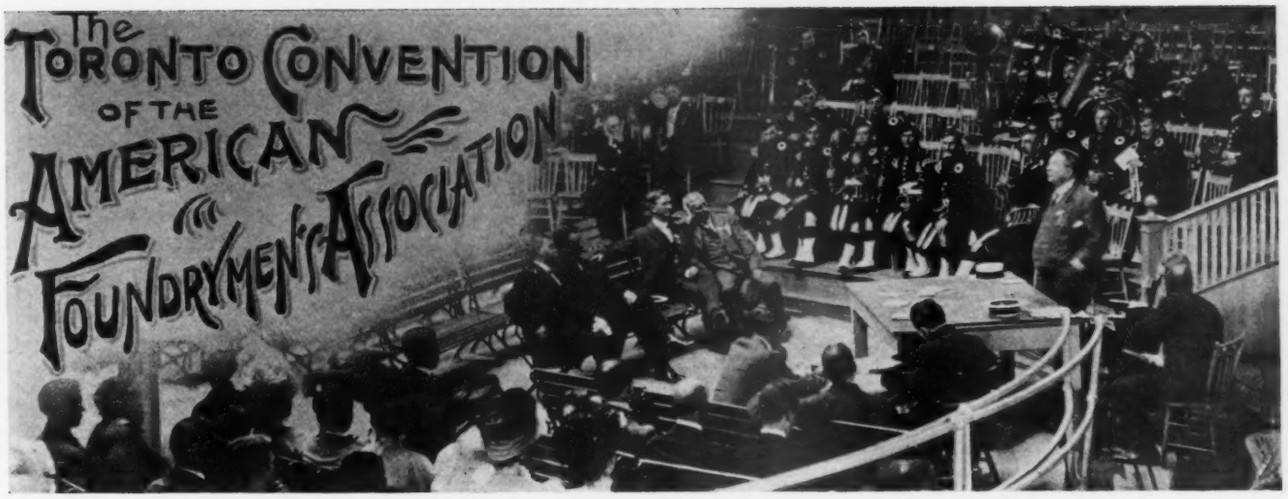
A unit link flexible shaft in which there is only one part to the unit has been placed on the market by the Coates Clipper Mfg. Co., Worcester, Mass., and is now being manufactured in sizes from 1/10 to 5 horsepower. The first flexible shaft made by this company, some 20 years ago, had 12 parts to a unit, making it very complicated to manufacture and rendering it necessary for the purchaser to carry a large number of replacement parts. For these reasons there has been a constant aim to reduce the number of parts to the unit, and the present shaft marks the accomplishment of that effort.

In this new shaft, on one end of the unit there is a squared spheroid which fits into a squared socket in the other end of the next unit and does the driving. A soft steel pin is used to hold the units together but there is absolutely no strain on this pin, as the drive comes directly on the squared portion of the squared spheroid. Each unit is made of hardened steel and any tearing strain on an extended socket is entirely eliminated. Between the squared spheroid and the squared socket on each unit there is a round shoulder which serves as a bearing, the result being that absolutely nothing comes in contact with the outside cover except a round shoulder, thus eliminating the possibility of heating, and admitting of a high rate of speed.

Owing to the construction of the shaft hitherto, it has been necessary to run at a high rate of speed in order to secure its full efficiency. In the construction of this latest unit, however, the factor of safety is so great in its transmission power that a full efficiency of the shaft may be obtained at a low rate of speed.

DETROIT FOUNDRYMEN'S ASSOCIATION.

"Malleable Cast Iron" was discussed by Dr. Richard Moldenke at the monthly meeting of the Detroit Foundrymen's Association held Monday evening, June 1. This organization has grown rapidly in membership and nearly 100 foundrymen are already enrolled.



Proceedings of the Annual Meeting of the A. F. A. and Allied Organizations

THE 12th convention of the American Foundrymen's Association held at Toronto, June 8 to 12 was unquestionably the most successful gathering in the history of this organization. The attendance was the greatest ever recorded, no less than 1,500 having registered throughout the week. The exposition feature again proved unusually attractive and in both number and variety the exhibits were the most complete ever shown. The interest in the papers prepared for discussion and the attendance at the various business sessions were also most encouraging to the authors of the papers and to the officers of the association, testifying, as they did, to the fact that it was not alone to see the latest in foundry equipment that the members and guests came so far to attend the convention.

The exhibition of foundry equipment and supplies as well as the meetings of the various associations were held in Exhibition park, the spacious buildings of which were admirably suited for this meeting. Municipal Toronto and Canadians in general extended the visiting foundrymen a hearty welcome as an evidence of appreciation for the selection of their beautiful city for the 1908 meeting. A commendable feature of this event, the more striking because of its entire absence at all previous gatherings, was the completed state of all the exhibits before the convention was officially declared open, a result which was due in large measure to the courtesy of the local entertainment committee and city officials in placing at the disposal of the exhibitors several weeks in advance of the date of the convention, the buildings at the fair grounds. Another feature worthy of passing praise was the selection of a detached building in which to hold the business sessions.

The meeting adjourned with the recommendation to the executive committee that the invitation of the Cincinnati foundrymen and business organizations to hold the 1909 convention in that city be accepted. Other invitations were proffered by Detroit, Pittsburg, Niagara Falls and Wheeling, and in accordance with the precedent established some years ago, future conventions will be held in the cities mentioned in the rotation named.

Canada was honored in the selection of a man for the office of president for the ensuing year. L. L. Anthes, of the Toronto Foundry Co., Toronto, Ont., is the new executive head of the association. He has been for several years actively interested in the work of the organization, and to his indefatigable efforts is due in large measure the success of this year's convention, as well as for the increasing number of his countrymen on the membership rolls of the association. The other officers elected are as follows:

Vice Presidents.

F. B. Farnsworth, McLagon Foundry Co., New Haven, Conn.

Wm. H. Parry, National Meter Co., Brooklyn, N. Y.

H. E. Field, Mackintosh, Hemphill & Co., Pittsburg.

J. W. Jeffrey, Ohio Malleable Iron Co., Columbus, O.

Samuel T. Johnson, The S. Obermayer Co., Chicago.

T. W. Sheriffs, Sheriffs Mfg. Co., Milwaukee.

J. W. Kissick, Columbus Iron Works, Columbus, Ga.

R. J. Cluff, King Radiator Co., Toronto.

Secretary and Treasurer.

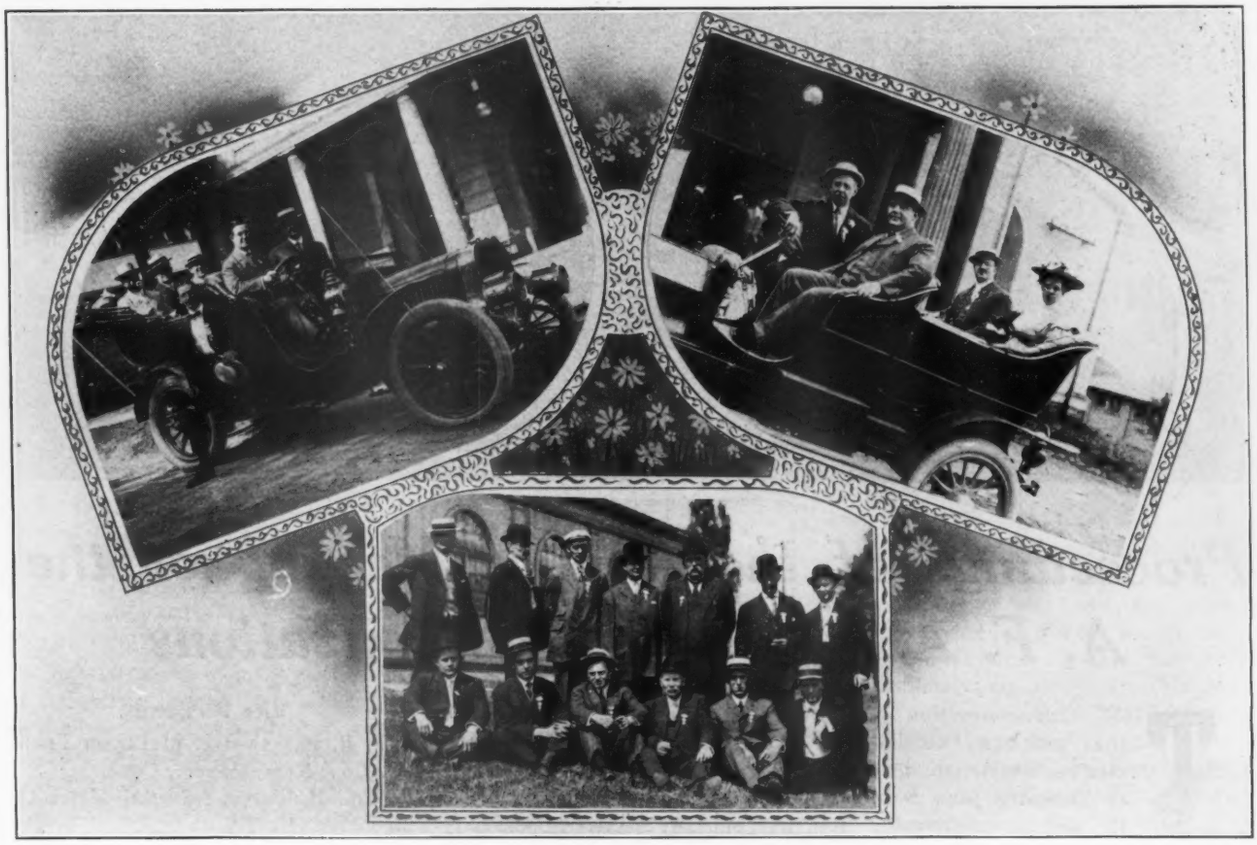
Dr. Richard Moldenke, Watchung, N. J.

The retiring president, Stanley G. Flagg Jr., was elected an honorary member.

At the concluding session, a motion was passed favoring the abolition of grading pig iron by numbers and the substitution of a system in which chemical analysis will be the determining factor. Another resolution carried with it the request that the American Society of Testing Materials appoint a committee to cooperate with the A. F. A. committee to draw up specifications providing for this change in the sale and purchase of pig iron.

Increase of Dues.

Another important resolution passed was that instructing the newly elected officers to take a referendum vote of the membership of the association on the question of the advisability of increasing the dues from $5 to $10 for



INCIDENTS OF THE TORONTO CONVENTION
DELEGATION OF ERIE FOUNDRY FOREMEN

H. F. Frohman had the Representatives of "The Big Three" Out for a Spin.

W. L. Kroeschell, E. H. Schwartz, J. S. and Mrs. McCormick, just returned from a ride through the parks.

the purpose of defraying the expense of further research work by the association. The resolution also carried with it the provision that a two-thirds' majority of the total membership in favor of the increase shall be sufficient to pass it.

Opening Session.

The opening session was held Tuesday afternoon at 2 p. m., Mayor Oliver of Toronto delivering the address of welcome. Responses were made by President Stanley G. Flagg for the American Foundrymen's Association: Charles J. Caley for the Brass Founders' section, E. H. Mumford for the Foundry Supply Association, and W. S. McQuillan for the Associated Foundry Foremen. In happy phrases Mayor Oliver expressed the gratification of himself and city for the privilege of being host to the several organizations represented, and hoped that their visit would result in freer business and social intercourse between the two nations. He dwelt on the business possibilities to Americans in Canadian expansion and hoped that the interest of his people in the American exhibits would induce many of the American manufacturers to establish branch factories in Toronto for the production of their products.

President Flagg's opening address was devoted to a review of the development of the American Foundrymen's Association and its labors in the years of its existence. While giving every praise for the good accomplished, the results of which had been of incalculable benefit to the foundry trade all over the world, he said that still further strides would have to be taken, not dreamed of when the organization was founded, to justify its existence and claim the continued attention of scientific men. To maintain the pace that had been set and accomplish the definite results expected of the association, more money than had hitherto been paid into the treasury of the organization would be required, and he put forth, as a matter for consideration the advisability of increasing the membership dues to provide these funds. He thought metallurgy and the more scientific side of foundry operations should be given greater attention in the future than had been allotted them in the past, and in this connection he deplored the lack of interest and assistance given by chemists and metallurgists to the work in hand.

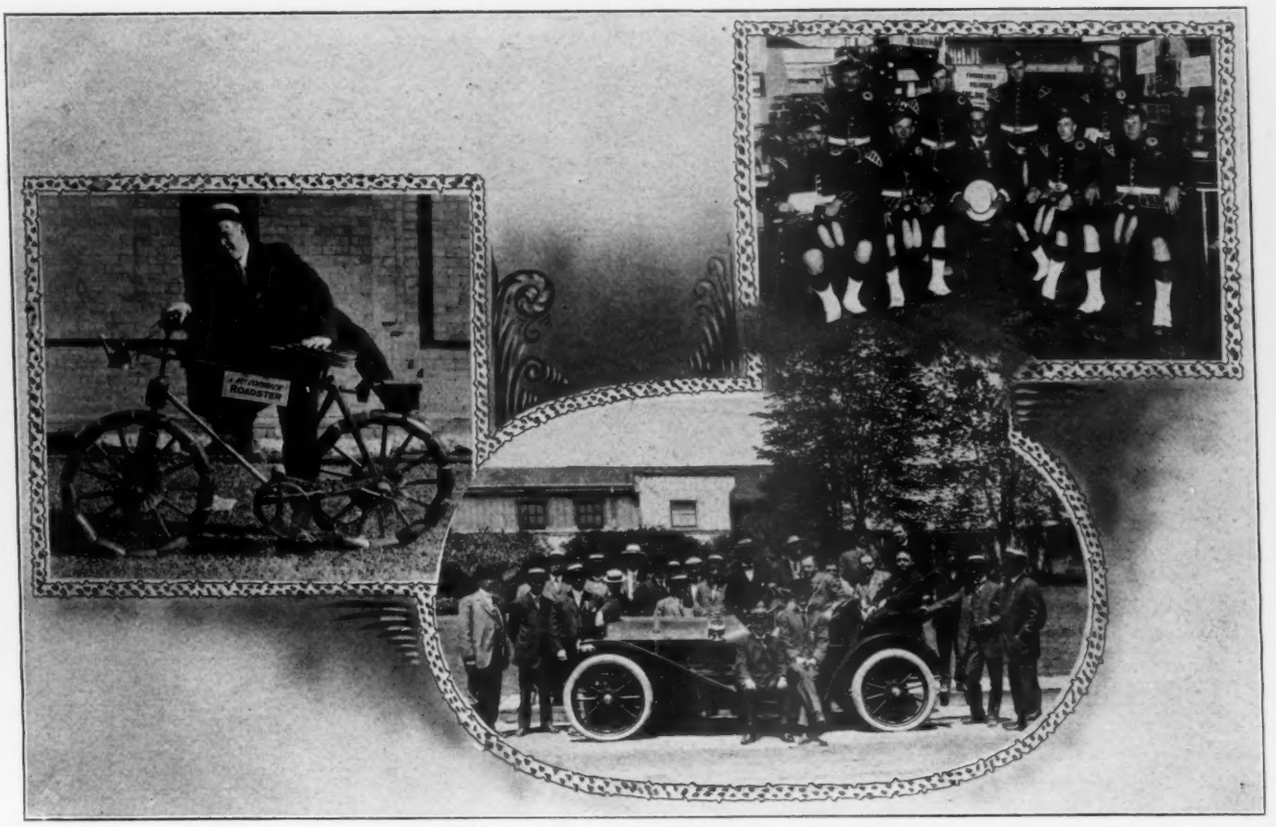
Report of Secretary-Treasurer.

Dr. Richard Moldenke then submitted the following report:

Perhaps no one thing has stimulated the educational movement in the foundry industry as much as the magnificent exhibition of foundry machinery and appliances at the Philadelphia convention held last year. Foundrymen are waking up to the fact that they must re-equip their plants to meet modern conditions, and the creation of these modern conditions are directly traceable to the work of our association. But for the dissemination of information on such subjects as the molding machine, the technical and scientific management of mixtures and melting, and other items of progress, the industry would not be where it is today.

We should therefore encourage the efforts of our allied supply association, and urge the individual manufacturers to continue to improve their product, so that the foundry industry of America may hold its place as the first in the world.

That foundry progress is firmly established now, can be seen from the flood of inquiry received by the secretary's office asking information on every conceivable phase of the art of founding metals. In a number of in-



INCIDENTS OF THE TORONTO CONVENTION

T. E. Malone mounting the McCormick Roadster.

The Highlanders find a long lost friend—S. T. Johnston.

R. H. York and Albert McDonald greeted by the Cleveland delegation upon the termination of their overland tour from Erie, Pa.

stances, foundry owners have brought their troublesome castings with them to New York to go over the situation with us, and it is hoped derived benefit therefrom.

Our president has told you of the effort made to raise a special fund for more effective studies to be made along the lines of important foundry problems, and your secretary is pleased to report that already two items of research work have been carried along sufficiently to report, and a third is well under way. These are the studies with vanadium in cast iron recently published in the *Transactions* and the use of titanium to be presented during this convention.

The study of molding sands is now far enough under way, so far as the gathering and preparation of the 50 odd samples is concerned, to indicate some very interesting results ahead. These sands were kindly donated to the association in sufficient quantity to make the experiments worth while. Further lines of investigation are contemplated, so that by the time of the next convention, we should have a substantial addition to our fund of knowledge.

Toward the end of the year, the burden of work became too great for the secretary alone, and hence assistance was engaged to cope with the ordinary routine. Over 200 pages of printed matter were issued to the members, and it is expected that next year more attention can be given the foundry reviews. Owing to the objection on the part of many members to the size of the publications, return is made to the old style, and our thanks are cordially tendered THE FOUNDRY for past favors which have saved us much money.

At the present time there are 715 members, which shows a gratifying increase over last year, and incidentally the regard in which the association is held.

Financial Statement.

The financial report follows:

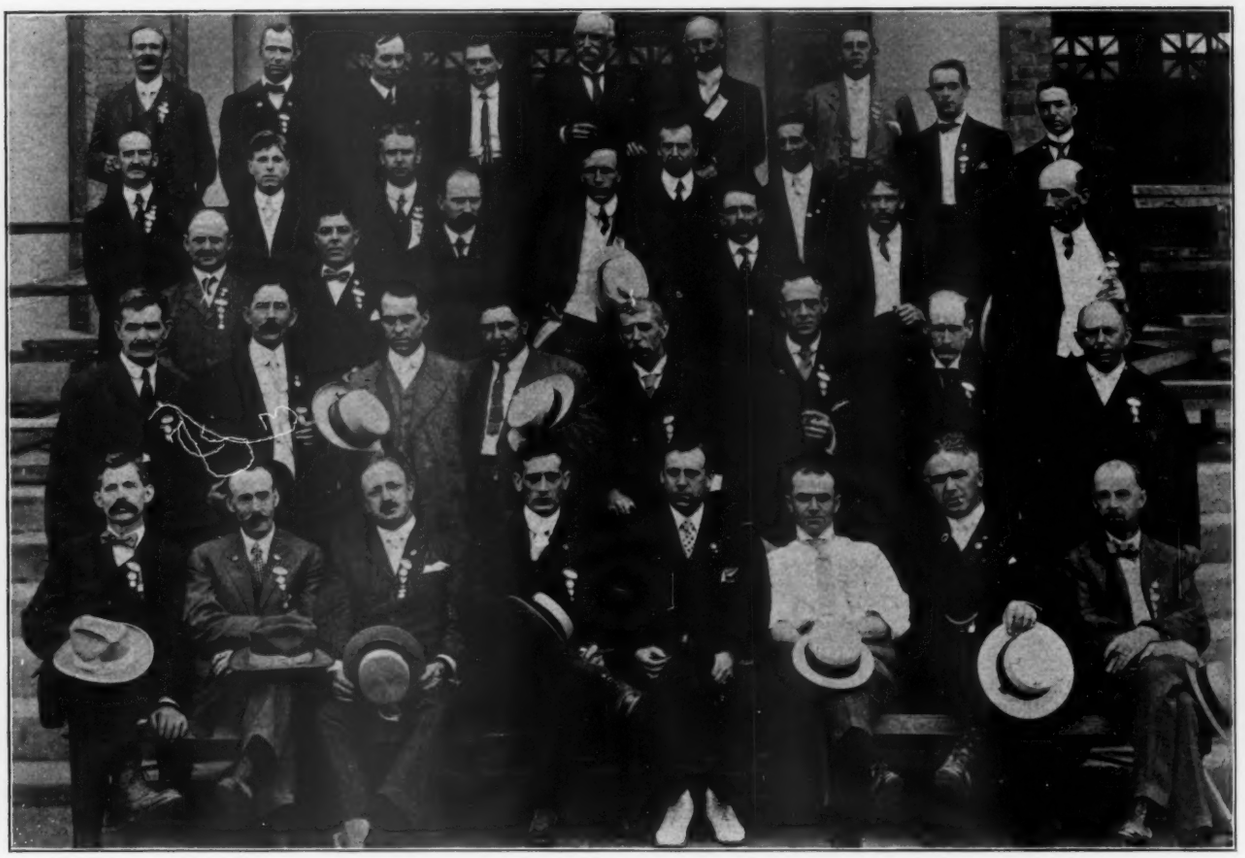
Balance from last year, $635.94, which included many dues paid in advance and in reality for this year. Received during the year for dues the sum of $2,180. Total income, $2,816.

Expenses: For the Transactions, $461.88; printing, $119.85; postage, $403; salaries, $1,357,05; sundries, $14.18; expense of committees and convention preparations, $135.01; total, $2,490.97, leaving a balance of $325.22 in the treasury.

The special fund collected amounted to $585. Expended for freight, labor, etc., $36.83, leaving a balance of $548.17.

Report of Cost Committee.

At the Philadelphia meeting in May, 1907, the "committee on costs" was reappointed for another year, with instructions to report at the 1908 convention. Several joint meetings with the committee representing Jobbing Founders' Association were held, and at the first of these it was deemed advisable that the committee of the two associations should work together. Under date of Nov. 27, 1907, Mr. Stirling, of Hilles, Jones & Co., who represented the jobbers in committee work, submitted to his association a report on "Uniform Cost Methods" for jobbing foundries which has since been approved and largely adopted by the members of that association. "Your committee," said the report, "recognizes that it is impossible to lay down hard and fast rules regarding the details of figuring costs, making estimates and basing tenders, but at the same time they feel that the best interests of the foundry business demand some degree of uniformity in the basic principles on which costs are figured. With this idea in mind the preparation of a chart outlining



CANADIAN DELEGATION AT THE TORONTO CONVENTION

the main divisions of costs was delegated to Harrington Emerson, and the chart as prepared by Mr. Emerson is submitted for your consideration. Your committee desire it to be understood that they only endorse this chart for general use so far as main divisions are concerned; details to be arranged in each instance according to the requirements of individual plants."

The final decision of the two committees was that to secure the best results certain clear-cut lines should be drawn, defining cost of product up to and including certain processes, but that further analysis of such costs should be in each instance left to the individual judgment of those in charge of the plants.

In view of the fact that in the majority of cases it is commercially impracticable to obtain records of the cost of individual castings the chart was designed with the idea of dividing the foundry output into classes, the number of which would depend on conditions and circumstances. In the chart the output is divided by Mr. Emerson into approximately 10 classes.

The actual cost of the foundry output has been divided into the following main divisions:

1. Metal.
2. Direct labor.
3. Indirect expenses chargeable on basis of weight of output.
4. Indirect expenses chargeable as a percentage of direct labor.

If those competing in the foundry industry for orders would base their figures on some such classification, subdivided to such detail as may be found advisable in individual cases, the result would, in the opinion of the committee, be of benefit to the entire trade, and would tend to eliminate the reckless competition to which is largely responsible the present unsatisfactory condition of the foundry business.

Wednesday Morning Session.

The paper prepared by L. N. Perrault, Waterbury, Conn., on "The Production of Automobile Castings," together with the papers on "Automobile Cylinder Making," by F. W. Stickle, Hartford, Conn., and on "Machine Molding," by E. H. Mumford, Philadelphia, Pa., were the most interesting of the entire session, and excited by far the greatest discussion. Mr. Perrault's paper dwelt on the difficulties incidental to the successful casting of water cooled cylinders with the jackets integral. A variation of 1/64th of an inch in one core only, he said, would cause the casting to be scrapped.

The great stress laid upon the necessity of saving in weight by the automobile engineer has made thin castings a necessity in cylinders with the water jackets cast integral. Little by little, the thickness has been reduced until the danger line was reached, when strengthening ribs were added, these coming as they do in the jacket core boxes, making the problem all the more difficult for the foundryman. Again the presence of bosses for the various studs, etc., often necessitate the use of internal chills to hasten cooling and prevent shrinkage. The enormous strains upon the cylinders in actual service by reason of vibration, and the unequal heating of different parts by the exploded gases, makes the question of strength an important one. Strong irons are by reason of their chemical composition inclined to be rather hard when cast into such thin sections yet the engineer demands a strong casting, which must machine uniformly and be absolutely free from either hard or spongy spots and sound in bosses and jackets. On the subject of mixtures he spoke as follows:

"As the result of careful study and patient experiment, the writer has settled on a mixture, which has stood the test of time and

MEMBERS OF THE ASSOCIATED FOUNDRY FOREMEN AT TORONTO

has been uniformly satisfactory, giving a tensile strength of about 36,000 pounds per square inch. Strange and complex are the opinions of some of the designers with whom we come in contact in the course of our investigations. An illustration: A says, 'I wouldn't use any but French castings; they are the only good ones made.' He kindly allowed me to take borings for analysis. B says, 'I have had them from France, Germany and Italy, but the only man I ever saw who could turn out a decent cylinder, was in a little shop in England, and he makes all mine.' I append the analysis of both, selecting these as the two extremes for your consideration:

France.	Per cent.
Silicon	1.72
Sulphur	0.110
Phosphorus	1.100
Manganese	0.590
England.	Per cent.
Silicon	2.73
Sulphur	0.083
Phosphorus	1.141
Manganese	0.41

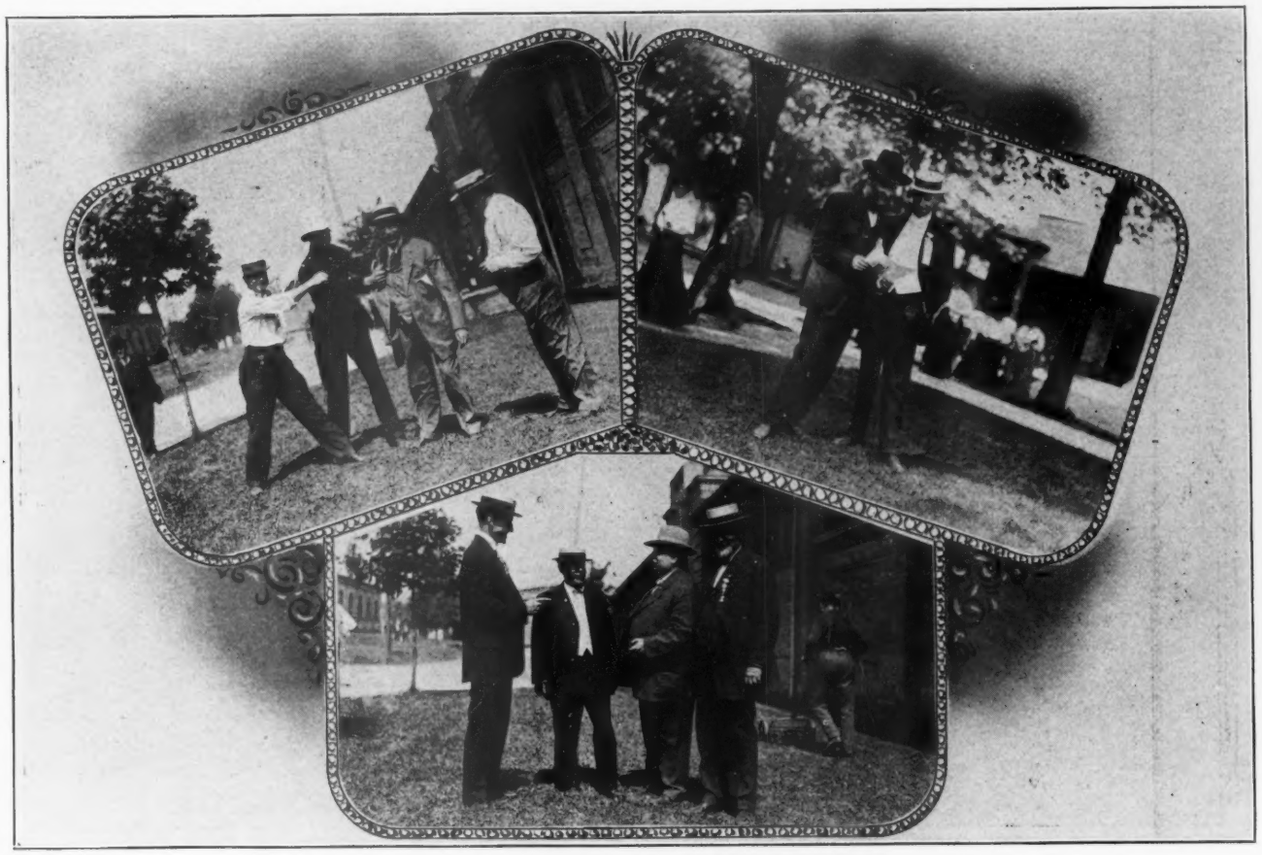
Mr. Perrault recommended the use of interchangeable iron flasks when the size of the order permitted; also that these should be as light as is consistent with safety. The patterns and core boxes should be of metal, or if wood, the parts most exposed to wear should be protected by metal facing; all loose bosses, etc., so fitted that even the slightest displacement could not occur; the bosses should also be cored to prevent shrinkage. The sand should be of fine texture and open grained; very carefully mixed and worked rather dry, and well blackened with a good grade of plumbago. These points if carefully observed, he thought ought to produce smooth round castings in green sand. Regarding the method of molding, he said:

"The following methods of molding are used in our foundry, each of which is governed by the type of pattern, size of order, etc. First, in this case one molder makes and casts his work. Second, the different parts of the pattern are fastened to mold boards and skilled molders used on the difficult parts and cheaper men on the simpler parts, while the coring, closing, etc., are done by another gang and the molds cast by laborers. Third, the patterns mounted on molding machines are operated all day by one gang, while the core setting, casting, etc., are done by others. The writer has in mind a certain cylinder for several years molded by the first method at a cost per cylinder of 66 2/3 cents each, which was later made on a three parted molding machine at a cost of 16 cents each, and on which there was a saving in cost in machine shop of 25 per cent over the old method of hand molding."

Shaking Out and Cleaning the Castings.

The question of freeing the casting from the cores and sand and whether it was better to pickle rather than tumble it came in for some attention, but the greatest interest was shown in the comparative analysis of the metals used in the various French and American cylinders. Mr. Perrault said it was his practice to pickle the castings first, because there is less risk of breakage than in tumbling; and, secondly because pickling softens the skin or scale, which otherwise is hard on the cutting tools; and lastly because dirty spots or other blemishes are more apt to be readily found than in a black polished surface.

J. J. Wilson, foundry superintendent of the Cadillac Motor Co., advocated the tumbling of the casting over the pickling method, because by the pickling process it could not be told whether the sand was all out of the chamber; furthermore, that the pickling process would harden the sand, making it impossible to remove it by later treatment. The tumbling of the casting will jar out the sand where there has not been any previous pickling. Referring to the analysis of French and American cylinders, Mr. Wilson stated he had had a number of the former analyzed and found that they varied in silicon from 1.64 to



INCIDENTS OF THE TORONTO CONVENTION

Joseph T. Speer consulting three former presidents of the A. F. A.—W. H. McFadden, T. D. West and J. S. Seaman.

L. A. Crandall runs afoul of the Canadian authorities, E. J. Woodison and W. R. Beers to the rescue.

Secretary Richard Moldenke consulting L. L. Anthes, president of the A. F. A.

about 2.30 per cent; in phosphorus from about 1.20 to 1.70 per cent. In the United States, the average analysis ran about 0.30 to 0.60 per cent phosphorus, and from 0.50 to 0.90 per cent manganese, the silicon from about 1.50 to 3 per cent. He thought the French castings would be very brittle and unable to stand much of a shock because of the high percentage of phosphorus in the iron, but presumed they used it because it was the only kind of iron obtainable. In answer to a question as to the relative amount of sulphur in the French and American cylinders, Mr. Wilson thought the two were about equal. He further stated that in his foundry he used the manganese both in the ladle and in the cupola, but preferred to use it in the pig iron. His next choice was in the cupola.

W. A. Jenkins, of the Oldsmobile Co., Lansing, Mich., gave the analysis of the metal used in 13 cylinders made by one French and 12 American firms. These are as follows:

	Tot. Carb. per cent.	Comb. Carb. per cent.	Mang. per cent.	Sulp. per cent.	Sil. per cent.	Phos. per cent.	Tensile Strength, pounds.
No. 1	3.35	0.51	0.43	0.094	2.31	0.05	22,360
No. 2	3.02	0.43	0.22	0.053	2.70	0.463	18,970
No. 3 (French).....	3.47	0.40	0.40	0.102	2.45	0.717	17,940
No. 4	3.34	0.10	0.469	0.083	2.59	0.566	15,880
No. 5	3.04	0.08	0.322	0.10	2.55	0.820	19,750
No. 7	3.24	0.098	0.385	0.111	2.67	0.733	23,930
No. 8	3.34	0.59	0.525	0.084	2.30	0.807	22,900
No. 9	3.74	0.65	0.410	0.083	1.60	0.536	18,460
No. 10	2.87	0.028	0.440	0.159	3.56	0.926	25,030
No. 11	3.52	0.624	0.476	0.091	1.72	0.578	25,260
No. 12	3.91	0.62	0.823	0.068	1.67	0.444	21,330
No. 13	3.61	0.75	0.518	0.093	1.38	0.620	14,710

F. W. Stickle, Hartford, Conn., said the analysis of the metal used by his firm in making automobile cylinders under date of April 9, 1907, was, total carbon, 3.17 per cent; combined carbon, 0.45 per cent; phosphorus 0.65 per cent; manganese, 0.69 per cent; sulphur, 0.13 per cent; silicon, 1.99 per cent. As they wished to get an elastic iron, the cylinders were always tested for transverse strength and not for the tensile limit. What they wanted was iron that would stand heavy shocks, and high tensile strength, in his opinion, was not particularly necessary in automobile work. Another analysis used by the company which he gave is as follows: Total carbon, 3.34 per cent; combined carbon, 0.76 per cent; manganese, 0.39 per cent; sulphur, 0.09 per cent; silicon, 1.89 per cent; phosphorus, 0.70 per cent. He had analyzed French cylinders and found the phosphorus always high. He thought the iron used was a straight pig iron—not a mixture. In their foundry he always used a composition made from different brands.

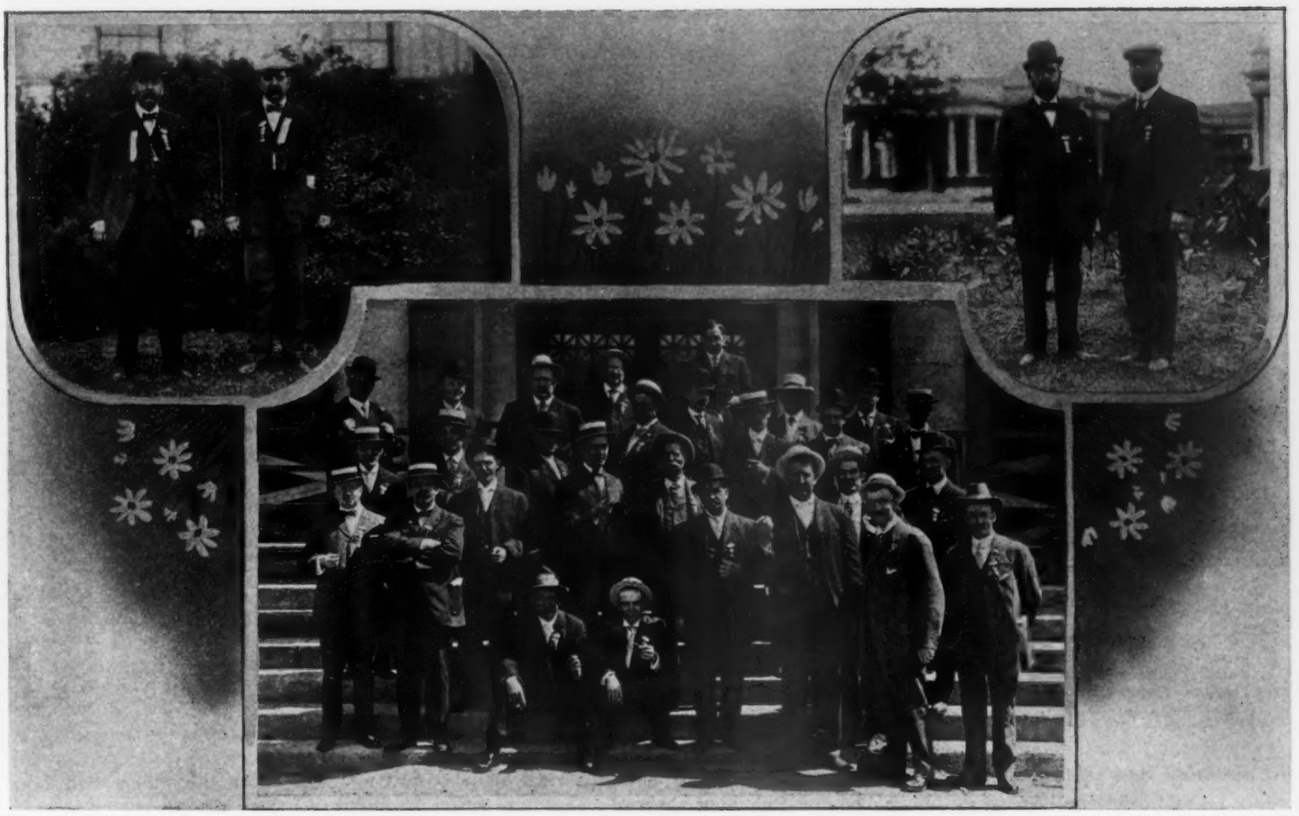
The paper presented by E. H. Mumford, Philadelphia, on "Machine Molding," was in the form of 10 questions, these to form the basis for a discussion on the subject. These were as follows:

1. Is there anything by which to appraise a molding machine other than the ratio of value of castings produced to cost of production?

2. When do portable molding machines pay better than stationary machines? Why?

3. When do stationary molding machines pay better than portable machines? Why?

4. What part of the work of machine molding is getting sand to machines and getting the molds off the machines to the floor, (a) in hand



A GROUP OF FOUNDRY SUPPLY MEN AND THEIR FRIENDS

David R. Steele and H. D. Harvey.

Chas. J. Caley, president, and John H. Sheeler, treasurer of the American Brass Founders' Association.

rammed or portable machines? and (b) in power rammed or stationary machines?

5. What increase of output is afforded stationary machines by power sand supply over that when sand is shoveled from the heap?

6. What increase of output is afforded stationary machines by immediate disposal of mold parts, so that the operator does not have to set and close his own work on the floor?

7. What does power sand supply cost per machine?

8. What does off-bearing of molds by off-bearers or power mold tables cost?

9. What is the limit of depth and the size of flask at which power-ramming by pressure ceases to pay?

10. What is the limit of depth and weight of mold at which jolt ramming ceases to pay?

Mr. Mumford prefaced his remarks by the reading of a letter from a manufacturer who stated a hypothetical case by which he sought to establish a fair remuneration for the molder operating a machine. The correspondent proposed that the individual molder—not necessarily a union molder—should appoint an expert to see what was the best he could do in hand molding on a certain piece of work, and the manufacturer should then take a machine and an unskilled operator and see what was the best that man could do on the machine. Having learned the cost of the hand and machine operations, the manufacturer proposed that the wage scale for the machine molder be determined on the basis of the manufacturer receiving the benefit of the saving of labor due to the machine and the molder receiving at least equal to the best he could do by hand molding.

Labor Conditions.

This hypothetical question, together with the 10 questions presented in Mr. Mumford's paper, led to an excited discussion which drifted into a channel entirely foreign to the objects of the association, the discussion of the attitude of union labor to the molding machine, and while it was admitted by the president that the remarks of the various speakers and the figures presented in the discussion were very illuminating, it was deemed desirable not to include the same in the minutes of the association because of the opposition on the part of those members who wished to keep the association entirely outside the pale of such controversy. It was the consensus of opinion, however, that to get the best results from the molding machine, there should be one gang of men making molds and another to pour off and shake out. In this manner, the output was increased and the cost reduced. To ask a molder to make 300 molds a day, which some believed was easily possible by the use of machines, and the same man pour off and shake out these castings, was a physical impossibility for any one man. There were several prominent stove founders present who also entered into the discussion, and the prediction of these was almost unanimous that the general use of machines in stove foundries was but a short time distant.

The paper by W. M. Carr, Chester, Pa., on "Annealing Castings," brought out the fact that while foundrymen are spending a great deal of money in their steel foundries for equipment to get good results, they are forgetting to anneal the castings when they are made. A steel casting, Mr. Carr said, should stand about 80,000 pounds per square inch, but because they were

INCIDENTS OF THE TORONTO MEETING.

W. S. McQuillan, president; F. C. Everitt, former secretary; and C. E. Hoyt, secretary of the Associated Foundry Foremen, and J. C. Pangborn, who has taken an active interest in the work of this organization in the east.

An exciting game, entitled the "Elusive Cubes." The party includes Geo. H. Wadsworth, Dr. E. E. Brown, A. A. Miller, Chas. J. Caley and John H Sheeler.

not annealed this strength was greatly reduced, and the author said cheap stock might as well be used instead of high grade pig iron.

The paper prepared by H. E. Diller, of Chicago, on "Specifications for Castings to be Machined" contained tables and figures presented with a view of getting specifications for castings which would machine easily and without much loss.

Wednesday Afternoon.

The papers presented at this session were as follows:

"Prevention of Accidents in the Foundry," by Thos. D. West, Sharpsville, Pa.

"Core Sands and Mixtures,'" by Archie M. Loudon, Elmira, N. Y.

"Ferro-Alloys in the Foundry," by W. M. Saunders, Providence, R. I.

"Titanium in Cast Iron," by Dr. R. Moldenke, Watchung, N. J.

"Foundry Warehouse Methods," by F. C. Everitt, Trenton, N. J.

"Pattern-Making for the Specialty Shop," by H. M. Lane, Cleveland, O.

"Foundry Transportation Methods," by David Gaehr, Cleveland, O.

"Oxy-Acetylene Welding of Castings," by G. H. Taylor, Philadelphia, Pa.

"Further Notes on the Application of Thermit," by N. E. Olds, Toronto.

Most of these were read by title. Dr. Moldenke's paper on "Titanium in Cast Iron," was a digest of the experiments he had conducted on the subject. He had several castings and photographs depicting the results of his experiments.

Thursday's Sessions.

The program for the business sessions Thursday morning and afternoon included the following papers:

"Cupola-Thermics,'" by S. H. Stupakoff, Pittsburg, Pa.

"Further Notes on Sandless Castings," by V. B. Lamb, New Haven, Conn.

"Chemical Reactions in Foundry Cupola Practice," by Jules de Clercy, Montreal, P. Q.

"Shop Management," by H. F. J. Porter, New York.

"Foundry Waste," by Harrington Emerson, New York.

"The Development of a Cost System for the Foundry," by E. M. Taylor, New York, member of cost committee.

"The Winona Technical Institute," by Prof. E. A. Johnson, Indianapolis, Ind.

"By-Product Foundry Coke," by G. A. T. Long, Chicago, Ill.

"Coke-Making in the United States," by Dr. R. Moldenke, Watchung, N. J.

Sandless Castings.

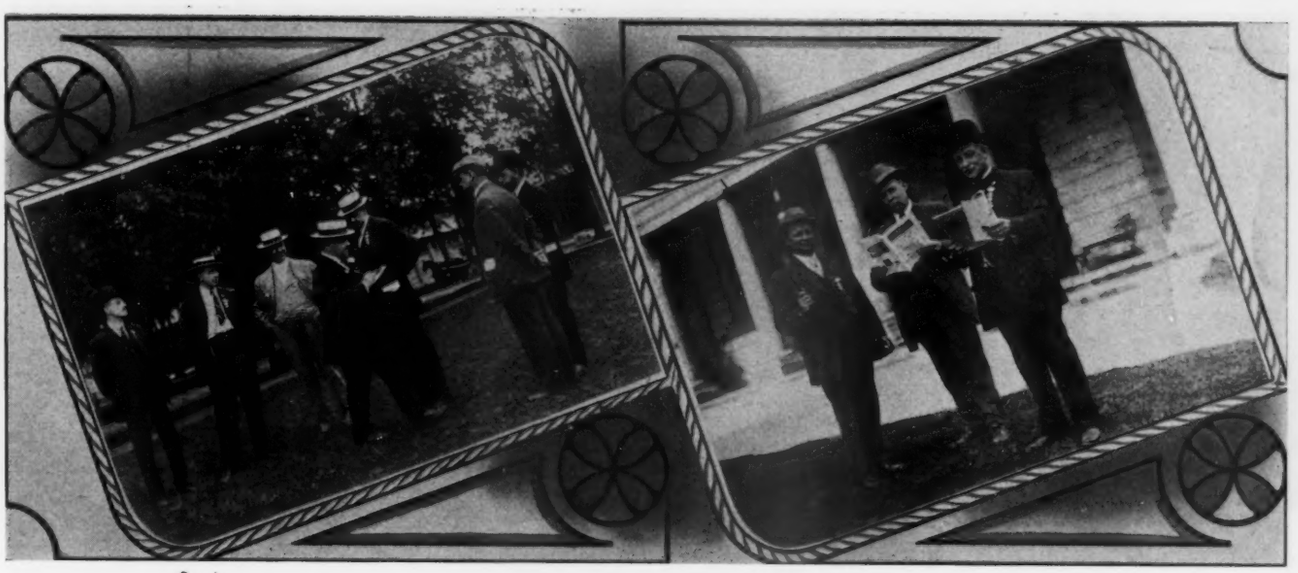
V. B. Lamb, New Haven, Conn., was unable to give the paper on "Further Notes on Sandless Castings," but as the secretary of the association had conducted the experiments with him, the members present were considerably enlightened as to the progress made. Brake shoes were cast in permanent iron molds, and when tested at Purdue university they proved to be the strongest and best brake shoes that had ever been tested at this institution. The molds were first brought to a black heat by pouring a couple of castings; these were thrown away, and it was only possible to get perfect castings after the molds had been heated to the required temperature by this method. Dr. Moldenke said, to get the best results, the composition of the metal to be cast should be near the composition of the chill; also that the molds should be placed in a circular pit, or on a revolving table. One member said he had used permanent molds in making gears. There was never any complaint of warping, but it was necessary to cast twice before the mold was brought to the right heat to make a perfect casting. President Flagg told of some German photographs he had seen showing machines making soil pipe. He said these particular manufacturers had not tried to use a permanent mold but simply a mold with a long life. In other words, the mold was intended to be used only long enough to make enough castings for a day's work.

The paper prepared by G. A. T. Long on "By-Product Coke," brought out no new facts except that a special grade of by-product coke was now being manufactured exclusively for foundry uses.

The report of the committee on costs, which is presented in another part of this report, together with the able and comprehensive remarks by Harrington Emerson and E. M. Taylor were extremely interesting, and both speakers were complimented on their presentation of the subject.

Industrial Education.

Chairman P. Kreuzpointer, of the committee on industrial education, presented a resolution testifying to the



INCIDENTS OF THE TORONTO MEETING.

An interested group—W. J. Haliwell, F. E. Maynard, H. A. Carpenter, H. E. Field, Chas. J. Caley and John H. Sheeler.

The Foundry chorus—C. O. Olson, W. M. Wilson and T. W. Sheriffs.

satisfaction felt by the association at "the increasing manifestations of interest in the United States and Canada by the schools and teachers in the important subjects of industrial education, and for their efforts to solve the problem of how best to adapt the school to new conditions of life."

Copies of this resolution were ordered sent to the various teachers' organizations in the two countries. A resolution of thanks to the school authorities of Toronto and Ontario, their teachers and principals, was also offered by the chairman of the industrial education committee in appreciation of the cordial welcome and courtesies shown him in his investigation and visits to Canadian schools, which was unanimously passed.

Another resolution adopted, requested that the new officers "carefully consider the question of allowing the president and secretary a proper per diem amount to defray necessary expenses when attending the annual convention."

Thomas D. West, Sharpsville, Pa., was appointed chairman of a committee authorized by the association to make an investigation of the causes of accidents in foundries and submit a report on the same at the next annual convention. Mr. West will select his own committee.

After the passage of the formal resolutions of thanks to the civic authorities of Toronto, the Canadian Manufacturers' Association; the local reception committee; to Mrs. and the Misses Anthes for their entertainment of the ladies; to the contributors of the papers read at the business sessions; to the retiring officers, and to the members of the Foundry Supply Association for the conveniences they had provided, the convention adjourned sine die.

Social Features.

The social features of the convention included a moonlight excursion on Lake Ontario Wednesday evening; trolley ride to Scarboro Beach, Thursday evening, and a smoker, Friday evening.

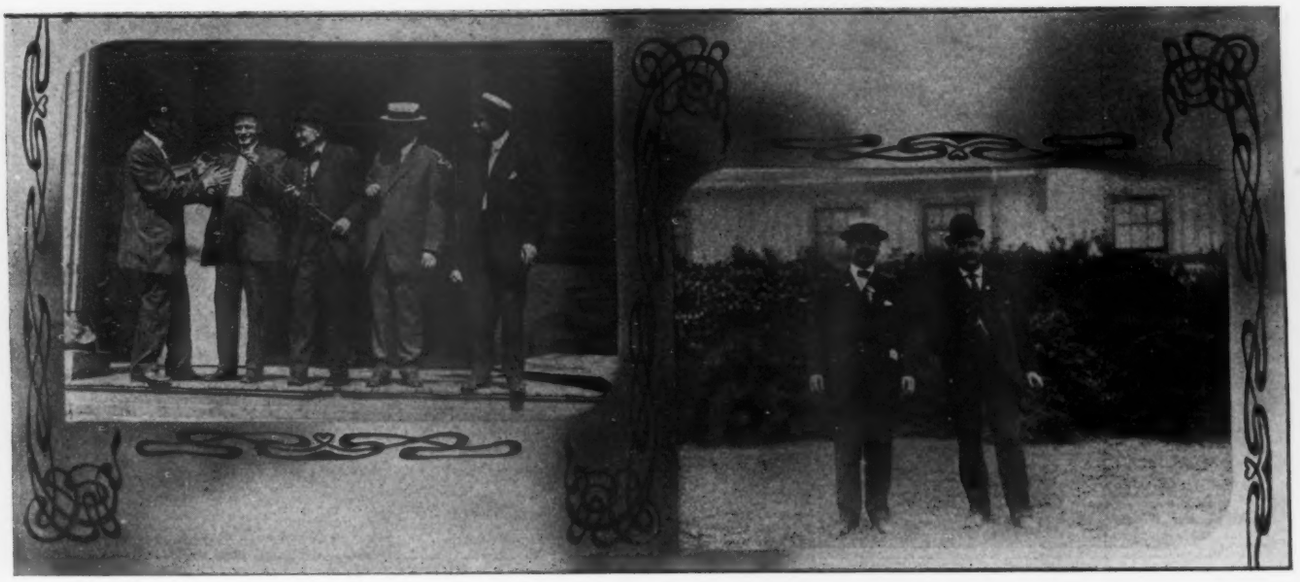
American Brass Founders' Association.

Apart from the joint sessions with the American Foundrymen's Association, the members of the American Brass Founders' Association held four meetings. At the first session on Wednesday morning, President Chas. J. Caley delivered his annual address which was in part as follows:

"As an association we are growing slowly but surely. Your secretary will report a membership of 150; considering the business depression of the country following our organization, this is remarkable. I desire to congratulate the officers for the good work accomplished. Special mention is due our secretary for his very able assistance, and our vice president, W. L. Abate, W. M. Corse and N. K. B. Patch. The business outlook is brighter than at any time since we organized and I look for a large increase in membership during the coming year, though to accomplish it will require a lot of hard work on the part of your incoming officers.

"In selecting your officers it is of the utmost importance that only men of known ability be elected, men who are enthusiastic workers in the cause they represent and who will do all they possibly can in their respective jurisdictions to help your secretary and president build up and maintain the standing of our association.

"The American Brass Founders' Association stands for the advancement of technical knowledge in the use of non-ferrous metals. Our purpose is purely educational—questions connected with labor or the regulating of prices are excluded. I make mention of these facts as I have been asked several times during the past year the object of our association. Further, we hope to accomplish much by the publication of papers read and discussed at our convention by our practical and scientific members, though to be successful in our undertaking we must be fully supported by all those interested in the production and commercial use of metals. This can be accomplished in no better way than by joining our association and sending to our convention your manager, foundry superintendent or foreman, your chemist, mill superintendent or anyone connected with your plant who is interested in the founding and working of the non-ferrous metals or their various alloys. This association should be of special interest to the metallurgists, especially those engaged in reducing metals from the ore. The professors of chemistry in our numerous universities and colleges can do much to attract scientific men to our association by bringing before our convention any metallurgical work done in their laboratories of an interesting character. I hope the incoming officers will do everything possible to induce scientific men to join us.



INCIDENTS OF THE TORONTO MEETING

J. N. Battenfeld extoling the merits of the famous Berkshire cane to Boughton, Sly, Atwater and Jacobs.

E. H. Mumford, former president, and F. N. Perkins, president, of the Foundry Supply Association.

To the American Foundrymen's Association is due the credit for bringing metallurgy, as applied to the iron foundry, up to its present state of efficiency. The same is true of standardized drillings and standard methods for analysis, standard methods of testing cast iron and the adoption of standard specifications for the purchase of pig iron.

I hope the 1908 convention of the American Brass Founders' Association will not adjourn until a committee has been appointed to make a like history for our association.

All mill men and foundrymen will recognize the importance of such a committee; all reliable smelters, refiners, metallurgists and chemists will, I believe, welcome a standard specification and the adoption of some standard method of analysis, so that copper, tin, lead, spelter and other nonferrous metals may be purchased with the knowledge that they contain certain properties best suited for the work in hand.

In closing let me voice my own thanks and those of every officer and member of this association for the international courtesy extended by Canada to the foundrymen of the United States and to the dignitaries and citizens of the city of Toronto for their hospitality.

Secretary's Report.

Secretary Andrew M. Fairlie reported 145 members enrolled, the receipts for the year amounting to $725, and after all expenses had been defrayed a balance of $245.45 remained. A paper entitled "Electro-Chemical Cleaning of Metals and Its Application to Commercial Uses," by Chas. H. Proctor, Arlington, N. J., was read by W. M. Corse. The author traced the development of electro-chemical cleaning baths, explained the arrangement of the same, the solution that should be used to obtain the best results and the method of operation. Secretary Andrew M. Fairlie, Copperhill, Tenn., followed with a paper entitled, "How to Use Your Membership Privileges." He suggested that all members of this organization should correspond with each other on technical matters and that they should seek facts and willingly impart them to others. Continuing, he said: "Correspond with your secretary, consider his office a bureau of information; collect accurate statistics of your operations and processes and be prepared to exchange figures with your fellow members; help to abolish the trade secret habit and you will get more than you give."

"The Outside Versus the Inside Man," was the subject of a paper read by W. A. Porter. In it he called attention to the arduous duties of the man employed in the office in charge of shipments, credits and other routine work.

Thursday Morning.

Oil burning furnaces, their efficiency, cost of operation, etc., were discussed at the Thursday morning session. F. A. Coleman, of the J. D. Smith Foundry Supply Co., Cleveland, opened the discussion by briefly reviewing the various types of oil melting furnaces in use. He suggested that information regarding the quality of metal produced under varying conditions and in various types of furnaces would prove valuable to foundrymen. Data should also be gathered regarding the melting costs, and he closed by saying that he would carry on a series of tests along this line during the year and would present them at the next meeting. W. S. Quigley, of the Rockwell Furnace Co., New York, stated that there are few furnaces that will not give good results provided they are properly operated. A paper on "The Value of Liquid Fuel in Brass Foundry Practice" was presented by W. N. Best, Brooklyn. The meeting closed with the reading of a paper on "Commercial Insulation," by F. H. Dimock. This was illustrated with a large number of lantern slides.

"Prolonging the Life of a Crucible" was discussed by Dudley A. Johnson, of the Jos. Dixon Crucible Co., Jersey City, N. J., on Thursday afternoon, and this was followed by a paper on "The Metallurgy of the Bronze Age in Europe," by W. M. Corse, Detroit. Other papers read at this meeting included "The Relation Between the Physical and Chemical Characters of Molding Sands," by Dr. Heinrich Ries, Ithaca, N. Y.; "Quality Versus Quantity," by J. N. Gamble, Kewaunee, Ill.

Election of Officers.

The meeting of the American Brass Founders' Association closed with the election of officers on Friday morning. Chas. J. Caley was re-elected president, and W. M. Corse, Detroit Lubricator Co., Detroit, was elected secretary to replace Andrew M. Fairlie, who refused the nomination owing to the pressure of his business affairs.

JOHN HILL EXTOLING THE BEAUTIES OF THE SIMPLE LIFE. HIS INTERESTED AUDIENCE CONSISTS OF PIONEERS OF THE FOUNDRY SUPPLY FRATERNITY

John H. Sheeler, of the Sheeler-Hemsher Co., Philadelphia, was re-elected treasurer. Among the vice presidents, the only changes made were as follows: A. H. Warner, F. Stebbins Mfg. Co., Springfield, Mass., succeeds W. K. Park, of the United Injector Co., Boston; Thomas Evans, Eynon-Evans Co., Philadelphia, succeeds G. W. Wright, Reading Hardware Co., Reading, Pa.. Chas. B. Bohm, Detroit, succeeds W. M. Corse, Detroit Lubricator Co., Detroit. J. Cessna Sharpe, Chattanooga, Tenn., succeeds Edro Richardson, Baltimore, Md.; Alexander Mitchell, Montreal, succeeds J. R. Meadowcroft.

Associated Foundry Foremen.

A phenomenal growth in the membership of the Associated Foundry Foremen was reported by Secretary F. C. Everitt at the first meeting of this organization held on Monday evening in the Process building. No less than 101 foremen were enrolled during the year, increasing the total membership to 500.

In the absence of President James F. Webb, W. S. McQuillan presided. After reading the minutes of the previous meeting, delegates from the various locals were called upon to briefly outline the work done by their organizations during the year.

Secretary's Report.

The following report of the secretary was then submitted:

"As we close the year with this, our sixth annual convention, we have all, no doubt, experienced the marked depression in business which has been so widely realized throughout the country. While we find some foundries well filled with orders, we will note that the number is comparatively small when we consider that there are 7,000 foundries in the United States and Canada.

"With these conditions fresh in our minds, we have reason to feel greatly encouraged in the work of foundry education, owing to the fact that the foundry associations have been advancing, during the past year with unexpected strides and we are now in position to say, with greater confidence than ever, that technical education in the foundry is an assured fact.

Mixing by Analysis.

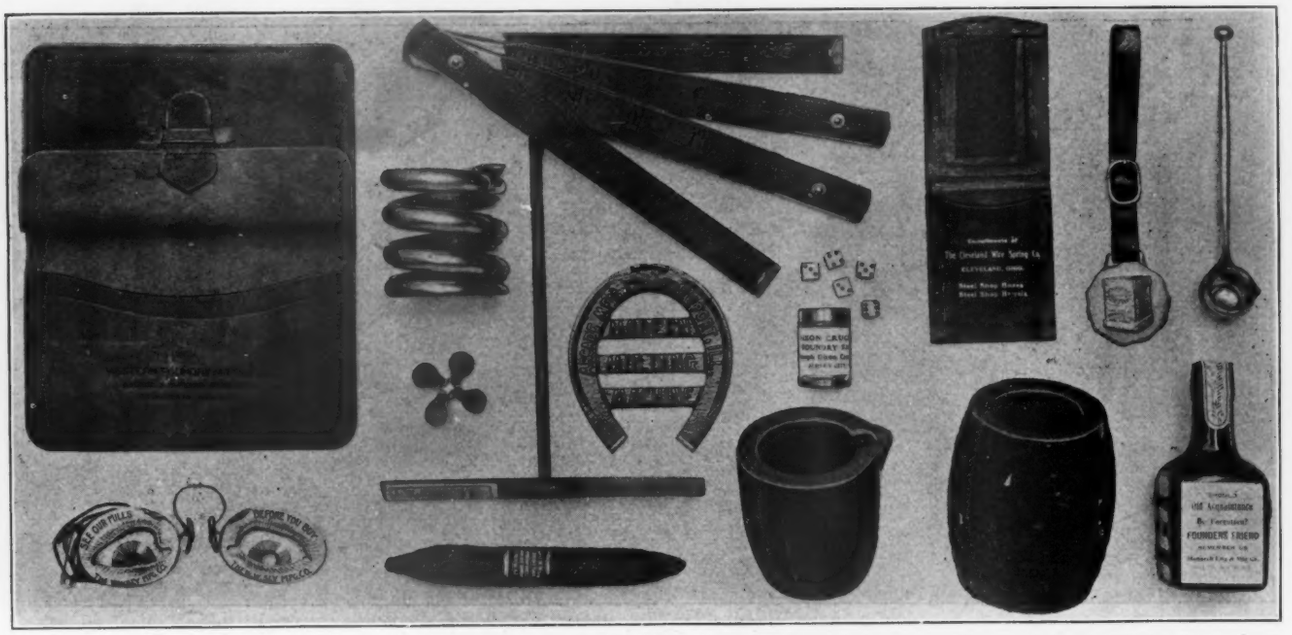
"The mixing of metals by analysis which has so long been studied and presented to us with the simplest of methods for calculation, is a subject with which nearly every foundry foreman in the country is now familiar. How many foundries today buy their iron by grades, mix by grades and then wonder what is the matter with the iron? Do we not order and specify the analysis? Do we not mix by analysis? Can we not better tell the cause of our trouble through these methods? There certainly can be no doubt because a daily analysis of the mixture made from pig which has been analyzed before it was accepted and in conjunction with standard test bars, enables us to control the quality of the iron to within exceedingly close margins. Again we find that we are able to reduce the cost of our mixture by knowing exactly what is going into the cupola and what is coming out, whereas, with the old rule of thumb method, the foundryman would have thought it worth his job to reduce his pig and increase his scrap or melt up some old pig that had been received and laid aside as useless for fear the next day's heat would be worthless, while, in fact, his iron might have increased in value.

"We are no less benefited by these methods in the purchasing of fuel. The same methods apply and we know what we are getting and how to use it.

Molding Machines.

"The advancement of molding machine practice during the last 12 months has been almost revolutionary. No less can be said of foundry appliances in general and all of which we will find on exhibition at this convention for the education of the foundrymen and general advancement of foundry technology.

"Through what medium has all this come to us—association—first, the American Foundrymen's Association, second, the Associated Foundry Foremen, third, the Foundry Supply Association, and fourth, the American Brass Foundrymen's Association. Can the foreman realize that today association is an essential part of his success as a foundryman? Can he realize that it is a part of his duty as a foundryman to become one of our members? Picture for yourself a man in the more remote portions of our states operating a foundry, too wise to visit another shop and gain information and his doors closed to visitors for fear his shop secrets will get beyond his wall. Do you consider that



A FEW OF THE MANY CONVENTION SOUVENIRS

his knowledge of foundry practice would get him a job as foreman in another shop? No—and why?—lack of association.

Association Work.

"These evident and more or less selfish motives of meeting our associates are a thing of the past and we are organized for the sole purpose of helping our fellow foundrymen by the exchange of ideas and at the meetings of our associations by the discussion of practical foundry topics.

"Aside from the technical part of our work, the association of man with man is an education in itself. We learn to read human nature, judge our fellow foreman, educate ourselves, to intelligently discuss the subjects that are most vital to our success and, above all, the ever growing spirit of frank non-secret tactics, fair advantages, all of which will substitute strength of position and strength of cause for strategy.

"We have at this time every reason to feel that the foundrymen are becoming thoroughly awakened to this spirit. We can readily recall the New York convention where there was an attendance of 400, at Cleveland an attendance of 800, at Philadelphia, 1,500, and there is every indication to believe that the attendance this year will be 2,000.

Growth of the Organization.

"We have received with our own association 101 members during the year, representing all parts of the continent east of the Rocky Mountains and from the Gulf to Canada. Many letters from firms wanting their foremen to become members have been received and a most valuable addition to the locals has been made through the efforts of our president, Mr. Webb, in the organization of the Tri-City Foundry Foreman's Organization, representing Davenport, Iowa, Rock Island and Moline, Ill."

Changes in the Constitution.

The report of the committee on constitution appointed in Philadelphia provoked considerable discussion. The following clauses were finally adopted:

"A president, two vice presidents at large, a secretary and treasurer shall be nominated by the nominating committee to be appointed by the chair, and shall consist of one representative or his proxy, as the locals may request, from each local association, and one representative at large.

"The nominating committee shall receive and consider all applications for the offices named in the previous section, and shall have power to decide which applications shall be presented at the annual meeting of the association for election.

"A president, two vice presidents at large and a secretary and treasurer shall be elected at the annual meeting, a majority vote being necessary to elect those decided upon and nominated by the nominating committee."

The committee on fuel reported progress and will continue its labors for another year. An invitation to meet in Cincinnati next year was then presented and was favorably acted upon provided the American Foundrymen's Association decided to hold its convention in that city in 1909. Dr. Richard Moldenke briefly outlined a plan for greater unity of action among the various foundrymen's organizations and to further consider this suggestion, as well as an amendment to the by-laws, it was decided to meet again Wednesday morning.

Election of Officers.

Officers for the ensuing year were then elected as follows: W. S. McQuillan, Warren, Pa., president; H. J. Holmes, Cincinnati, first vice president; James Gaffney, Montreal, second vice president; C. E. Hoyt, Chicago, secretary and treasurer; district vice presidents, Erie Pa., W. F. Grunau; Milwaukee, Henry Biegal; Chicago, E. W. Smith; New York, D. C. Wilson; Indianapolis, W. A. Kellar; Cleveland, C. A. Olson; Philadelphia, W. A. Perrine; Hamilton, Ont., David Reid; Cincinnati, John Logan; Montreal, M. J. Walsh; Davenport, Ia., James F. Webb. F. C. Everitt, to whose untiring efforts and indefatigable energy the growth of the association is largely due, insisted upon the acceptance of his resignation as secretary, notwithstanding the fact that his name was again presented for this office by the nominating committee.

Wednesday Morning.

At the meeting held on Wednesday morning the committee consisting of A. M. Loudon, W. A. Perrine, E. W. Smith, H. J. Holmes, and F. C. Everitt presented the following amendment to the by-laws and resolutions which were adopted:

"There shall be an executive committee composed of the delegates from

MEMBERS AND GUESTS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION AT TORONTO, JUNE 11, 1908

The Foundry, July 1908.

each local association. This committee to act in conjunction with the president and secretary during the interim between conventions. Said executive committee to have full power to act in all matters appertaining to the welfare of this organization.

Resolved: That the president, first vice president and secretary-treasurer shall be designated as a special committee to confer with similar committees during the year, from the American Foundrymen's Association, the American Brass Founders' Association and the Foundry Supply Association.

Resolved: That it be a recommendation of this committee to the executive board that they at once open negotiations with each local with the end in view of having them all affiliate with and be a part of the national association. The questions of dues and finances to support the national association to be submitted by the executive board to the local associations.

Resolved: That the remaining suggestions submitted by the committee, which was apointed at the last convention, be acted upon by the executive board as outlined in the above resolutions.

A change in the name of the organization has also been suggested and this will probably be acted upon by the executive committee during the year.

ANNEALING CASTINGS.*

By W. M. Carr

In the manufacture of chilled cast iron car wheels no dispute exists regarding their treatment in annealing pits. They would never be shipped or put into service without such treatment. The value of the treatment is fully recognized and receives as much attention and care as any step in their manufacture.

In the production of gray iron castings, annealing is sometimes followed with a view to lessening certain stresses or strains set up in the cooling of the castings from the pouring temperature. The influence of the process in the case of gray iron upon the formation of the carbon compounds is not so important. If, however, changes should occur they would be in the direction of softening the surface of the castings.

Steel Castings.

Coming to the steel casting industry we have a very important one in which annealing is open to some doubt. It may be the practice or it may not. That it has some value is a settled fact, but is not generally so recognized. When specifications so demand, steel castings are put through an annealing furnace, frequently without any consideration as to the conditions of time and temperature. In the absence of annealing specifications steel castings are frequently shipped without such treatment.

Here we have the paradox of pains taken in the selection of raw materials, watchful manipulation of the melting and refining process in converting pig iron and steel scrap of proper quality into steel, pouring it into molds of particularly refractory sand, stripping and cleaning followed by rigid inspection for flaws and imperfections outwardly visible and finally shipping to customer without annealing, delivering the castings with unknown stresses present, course, internal structure, and other variables more or less liable to vitiate the value of the castings in service.

Importance of Annealing.

If a casting shipped under such conditions should fail in service, all the precautions thrown around the methods of treating the raw material entering into it are wasted. The casting may be smooth, solid, true to pattern, of the proper chemical composition and the test bars examined from the same heat of steel meet standard specifications in tensile strength, etc., still with all apparent evidences in its favor, if it is not annealed before going into service there will always remain a doubt as to the life of usefulness. The casting may fail unexpectedly. I do not mean to say that annealing will make the casting infallible, but I do know with other conditions being equal that an annealed casting is less liable to fail in service than one not annealed. Surely, then, on the ground of consistency, in the light of modern methods, taking due consideration of all the preliminary operations leading up to the finished casting and eventually ignoring or slighting the final step of annealing, the step is of enough importance to demand proper attention.

Annealing Changes.

In annealing steel castings we have conditions that are not entirely comparable with conditions existing in other branches of the foundry industry where annealing is more or less essential. The operation is not concerned with the changes in the carbon compounds. That is to say, the same carbide of iron will be present, both before and after the treatment. In the matter of internal structures there are mainly two components, first, the crystalline formation and its refinement resulting from proper thermal treatment, and secondly, the removal or lessening of internal stresses set up in cooling down from the casting temperature. It is peculiar to most metals that they should crystalize when cooling from a temperature at which they are cast and the size of the crystals vary with the temperature and rate of cooling. The size and formation of the crystals have a decided influence upon the physical properties of the castings. Upon reheating metals to what is known as a refining or annealing temperature, the grain or crystals of the metal will become smaller than their original form, and with the change in structure will come better conditions physically. The castings will be tougher and better fitted to accomplish the work for which they may be designed. The refining temperatures are not the same for all metals, but generally speaking a suitable temperature to grain refine cast steel is about 825 to 850 degrees Cent.

There are, however, practical considerations to take into account that cannot be determined entirely by laboratory tests, such as the length of time to anneal a casting of a given shape and size, the style and type of furnace best suited to certain requirements. These points are capable of determination through the character of the product and the probable tonnage.

*Presented at the annual meeting of the American Foundrymen's Association.

SAND FOR MOTOR-CYCLE CYLINDERS.

By W. J. Keep

Question:—I would like to know the best sand to use in making molds for small air-cooled motor-cycle cylinders. What is the best binder to use in the sand?

Answer:—You should use an open free vented machinery sand. You can ascertain the right kind by consulting the concern from which you purchase your supplies. You do not need to add any binder as the natural loam is the best binder. If you are asking about cores you can find a suitable core sand in your vicinity. Michigan City sand is excellent for small cores, but may be too fine for auto cylinders. Linseed oil is excellent for a binder.

VICTOR METAL.

This alloy is whiter than German silver, which it can often replace, though harder to work. It withstands the effect of salt water and is chiefly utilized for marine engines. It is composed of copper, 49.94; zinc, 34.27; nickel, 15.40; aluminum, 0.11, and iron, 0.28.

USE OF TITANIUM IN CAST IRON*

The Results of a Comprehensive Series of Tests with this Alloy Show a Great Increase in the Strength of Gray Iron

BY RICHARD MOLDENKE

AMONG the numerous applications of electrical energy, none stands higher in the eyes of the iron and steel metallurgist than the electric furnace. Ferro-alloys in which metals formerly regarded as practically infusible can now be obtained for simple addition to the ladle and their effect studied, and the reduction of the cost to a commercial point, has brought us nearer to the much sought goal of physical perfection in our iron products.

Probably no one man has done more to study the scientific and commercial side of titanium as applied to iron and steel than Auguste J. Rossi. From having the blackest kind of a reputation in the blast furnace, Mr. Rossi has given titanium a place in the metallurgy of iron which is beginning to grow in importance. The benefit to be derived from formerly despised material and the eventual opening up of immense resources of ore heretofore considered valueless, will remain the greatest monument of a career of unselfish labor and sacrifice.

Of the two methods of preparing titanium for use in iron, the aluminothermic and the electric furnace, the latter seems destined to make the cheaper product, and as the selling price of a 10 per cent titanium-iron alloy is now within commercial limits, its use for the foundry is worth considering closely. For this purpose a series of tests was instituted on behalf of the American Foundrymen's Association, the results of which are given herewith.

Alloys Used in the Tests.

In the preliminary tests two classes of alloys were tried, one in which the material was free from carbon, and the other having some 5 per cent of this element present. The tests showed that while both alloys could be used for the rather small quantities of iron treated, the carbon-titanium alloy was better adapted for foundry work, as the melting point is lower. However, the alloy free from carbon can be used in the foundry where large bodies of metal are to be treated, and time can be given for a thorough incorporation of the material.

The apparent infusibility of the titanium-iron alloys has heretofore militated heavily against their use, and hence a word about this matter. When the lumps of alloy are thrown into the ladle, they must be given time enough to heat up and alloy with the bath by thorough stirring. This takes some time, and usually, especially with steel, fear that the metal may cool too much results in pouring before the titanium has had time to act. Hence the writer suggests that where large lumps of either alloy are used that these be heated up to redness in any convenient way before use.

Results of the Tests.

In making the tests in question, the standard 1¼ D. test bar cast on end in a dry sand mold was used. The bars were brushed clean and then tested transversely on supports 12 inches apart. Two classes of metal were used, broken car wheels and machinery pig iron. This gave gray iron and white iron castings. The alloy contained 10 per cent titanium, so that one pound alloy to 100 pounds of iron would mean the addition of 0.1 per cent of titanium.

Table I.

Machinery pig (gray iron). No titanium alloy added.

No.	Broke at pounds.	Deflection, inches.
1	2,240	0.10
2	2,260	0.10
3	2,010	0.09
4	1,840	0.08
5	1,970	0.08
6	2,150	0.10
7	2,100	0.10
8	1,770	0.09
9	1,890	0.10
Average	2,020	0.09

Analysis of pig iron: Silicon, 2.58 per cent; sulphur, 0.042 per cent; phosphorus, 0.540 per cent; manganese, 0.74 per cent.

Table II.

Machinery pig (gray iron). 0.05 per cent titanium, no carbon added.

No.	Broke at pounds.	Deflection, inches.
10	3,140	0.09
11	2,750	0.09
12	2,880	0.09
13	3,070	0.09
Average	3,100	0.09

Table III.

Machinery pig (gray iron). 0.05 per cent titanium, carbon added.

No.	Broke at pounds.	Deflection, inches.
14	3,050	0.09
15	3,140	0.10
16	3,150	0.10
17	3,239	0.10
18	2,850	0.10
19	2,990	0.09
Average	3,070	0.10

Table IV.

Machinery pig (gray iron). 0.10 per cent titanium, no carbon added.

No.	Broke at pounds.	Deflection, inches.
20	2,880	0.09
21	3,070	0.09
22	3,150	0.09
Average	3,030	0.09

Table V.

Machinery pig (gray iron). 0.10 per cent titanium, carbon added.

No.	Broke at pounds.	Deflection, inches.
23	3,080	0.09
24	2,850	0.09
25	2,850	0.09
26	3,150	0.10
27	3,050	0.10
28	2,880	0.10
Average	2,990	0.095

Table VI.

Machinery pig (gray iron). 0.15 per cent titanium, carbon added.

No.	Broke at pounds.	Deflection, inches.
29	3,270	0.11
30	3,030	0.10
31	3,270	0.10
32	3,180	0.10
Average	3,190	0.10

A test with 0.15 per cent titanium in the alloy free from carbon, failed, as the metal had to be poured before the alloy was completely dissolved.

Table VII.

No.	Broke at pounds.	Deflection, inches.
33	2,540	0.09
34	3,020	0.10
35	3,000	0.10
36	2,740	0.11
37	3,260	0.10
38	3,300	0.10
39	2,420	0.10
40	2,300	0.09
41	2,880	0.09
42	2,810	0.09
43	3,250	0.10
44	2,570	0.09
45	2,980	0.10

Average not taken, as the results show irregularity due to portions of the metal being treated and the other portions not.

Machinery pig (gray iron), titanium alloy free from carbon placed on the coke bed of the cupola, and metal charged above making the titanium addition 0.10 per cent.

It will be noted that the variation in strength is from 2,300 up to 3,300, or practically the range of results ob-

*Presented at the annual meeting of the American Foundrymen's Association.

tained by adding the alloy to the ladle, but the results are not uniform.

Table VIII.

Scrap car wheels (white iron), no titanium added.

No.	Broke at pounds.	Deflection, inches.
46	2,110	0.05
47	2,100	0.05
48	2,110	0.05
49	2,000	0.05
50	1,920	0.04
51	2,060	0.04
52	2,070	0.05
53	2,010	0.04
Average	2,050	0.05

Analysis of car wheels: Silicon, 0.85 per cent; sulphur, 0.07 per cent; phosphorus, 0.420 per cent; manganese, 0.60 per cent.

Table IX.

Scrap car wheels (white iron), 0.05 per cent titanium, no carbon added.

No.	Broke at pounds.	Deflection, inches.
54	2,310	0.06
55	2,660	0.06
56	2,260	0.05
57	2,210	0.05
58	2.440	0.05
59	2,420	0.05
60	2,400	0.05
61	2,440	0.05
62	2,480	0.05
63	2,440	0.05
64	2,310	0.06
Average	2,400	0.05

Table X.

Scrap car wheels (white iron), 0.05 per cent titanium, carbon added.

No.	Broke at pounds.	Deflection, inches.
65	2,420	0.05
66	2,610	0.05
67	2,340	0.05
68	2,720	0.06
69	2,230	0.06
70	2,430	0.05
71	2,440	0.05
72	2,320	0.05
73	2,300	0.06
Average	2,420	0.05

It was not possible to get good results with larger quantities of the alloy free from carbon, as the white iron chilled too quickly.

Table XI.

Scrap car wheels (white iron), 0.10 per cent titanium, carbon added.

No.	Broke at pounds.	Deflection, inches.
74	2,380	0.05
75	2,460	0.05
76	2,440	0.05
77	2,340	0.05
78	2,420	0.05
79	2,320	0.05
80	2,360	0.05
81	2,440	0.05
82	2,400	0.05
83	2,400	0.05
Average	2,400	0.05

Table XII.

Scrap car wheels (white iron), 0.15 per cent titanium, carbon added.

No.	Broke at pounds.	Deflection, inches.
84	2,600	0.06
85	2,590	0.06
86	2,500	0.06
87	2,620	0.06
88	2,300	0.05
89	2,580	0.06
90	2,280	0.06
91	2,590	0.07
92	2,430	0.06
93	2,600	0.07
Average	2,520	0.06

Summary of Results.

	Tests.	Pounds.
Original iron, gray	9	2,020
Plus 0.10 titanium	4	3,100
Plus 0.10 titanium	3	3,030
Plus 0.05 titanium and carbon	6	3,070
Plus 0.10 titanium and carbon	6	2,990
Plus 0.15 titanium and carbon	4	3,190
Average		3,070

Increase in strength, treated iron over original, 52 per cent.

	Tests.	Pounds.
Original iron, white	8	2,050
Plus 0.05 titanium	11	2,400
Plus 0.10 titanium	..	....
Plus 0.05 titanium and carbon	9	2,420
Plus 0.10 titanium and carbon	10	2,400
Plus 0.15 titanium and carbon	10	2,520
Average		2,430

Increase in strength, treated iron over original, 18 per cent.

From the above summary it will be seen that the greatest increase in strength was brought about in the gray iron, which is of interest in connection with the recent tests made with vanadium in cast iron where the contrary was observed. The improvement in gray iron is more marked than was the case in tests made by Mr. Rossi and the writer in 1902. The same peculiarities, however, were observed in the behavior of the metal, as will be described later.

CHILL PIECE, SHOWING LARGE EXCRESCENCE OF METAL AT THE TOP

Looking over the averages above presented, it will be noted that the improvement is almost as marked whether 0.05, 0.10, or 0.15 per cent titanium was used, which would seem to indicate that once the deoxidation has been effected, any additional titanium added is partially wasted. Hence for ordinary foundry practice, 0.05 per cent titanium added will be practically sufficient, larger amounts only being necessary in exceptionally bad cases or for special work.

Reduction of Chilling Action.

A further curious fact in connection with the use of titanium in the foundry is the lessening of the chilling action. And yet whatever chill may remain shows very much harder iron. This is important in car wheel work. Test pieces made in the Keystone Car Wheel Works, Homestead, Pa., with iron which chilled 1½ inches deep, when treated with titanium in the ladle gave but 1 inch chill. Prisms cut from these chilled portions, the castings having been made from the same metal, when subjected to compressive strain, and also tested for hardness with Brinel's test (use of diamond) gave the following results:*

Original iron crushed at 173,000 pounds per square inch and stood 445 in the test for hardness, soft steel running about 105. The treated piece ran 298,000 pounds per square inch and showed a hardness of 557. Testing the soft metal below the chilled portion for hardness gave 332 for the original and 322 for the treated piece, or practically the same material so far as hardness was concerned.

Remelting Titanium Iron.

The writer wishes to call attention to another curious phenomenon in connection with these tests. In order to see what effect the remelting of a titanium pig iron would exhibit, a special batch made in the electric furnace, containing 3.14 per cent titanium, and 5.78 per cent graphite, was run through the cupola. The product was cast into test bars the usual way, and part of one ladle into a chill cup. The metal as it came from the electric furnace originally was so tough that it could be broken only with severe exertion. Much of this strength was lost in the cupola remelt, and the composition of the bars was as follows:

	Per cent.
Silicon	0.97
Sulphur	0.067
Phosphorus	0.064
Manganese	0.27
Graphite	3.18
Total carbon	3.94
Titanium	0.72

An average of the eleven bars cast gave 2,290 pounds, though this is of no special value, lacking comparison with other tests. The bars were dark gray, where one would expect a heavily mottled or at least only very light shade of gray to exist, considering the composition and comparatively small diameter. It was noticed, however, that the bars when cast retained their heat at least three times as long as ordinarily, and this opportunity for graphite to form may account for the dark gray fracture.

Now the further curious fact with this experiment was seen in the chill piece cast from the same ladle as some of the bars. The metal set in such a way that a large excrescence was forced out at the top as shown in the accompanying illustration. Further, when the chill piece was broken,

*Tests made by Mr. Hokanson of the Carnegie Technical Schools.

the fracture showed distinctly the cross of St. Andrew, in its crystallization. Incidentally, the graphite of the chilled piece was 0.05 per cent. the other constituents being practically the ones given.

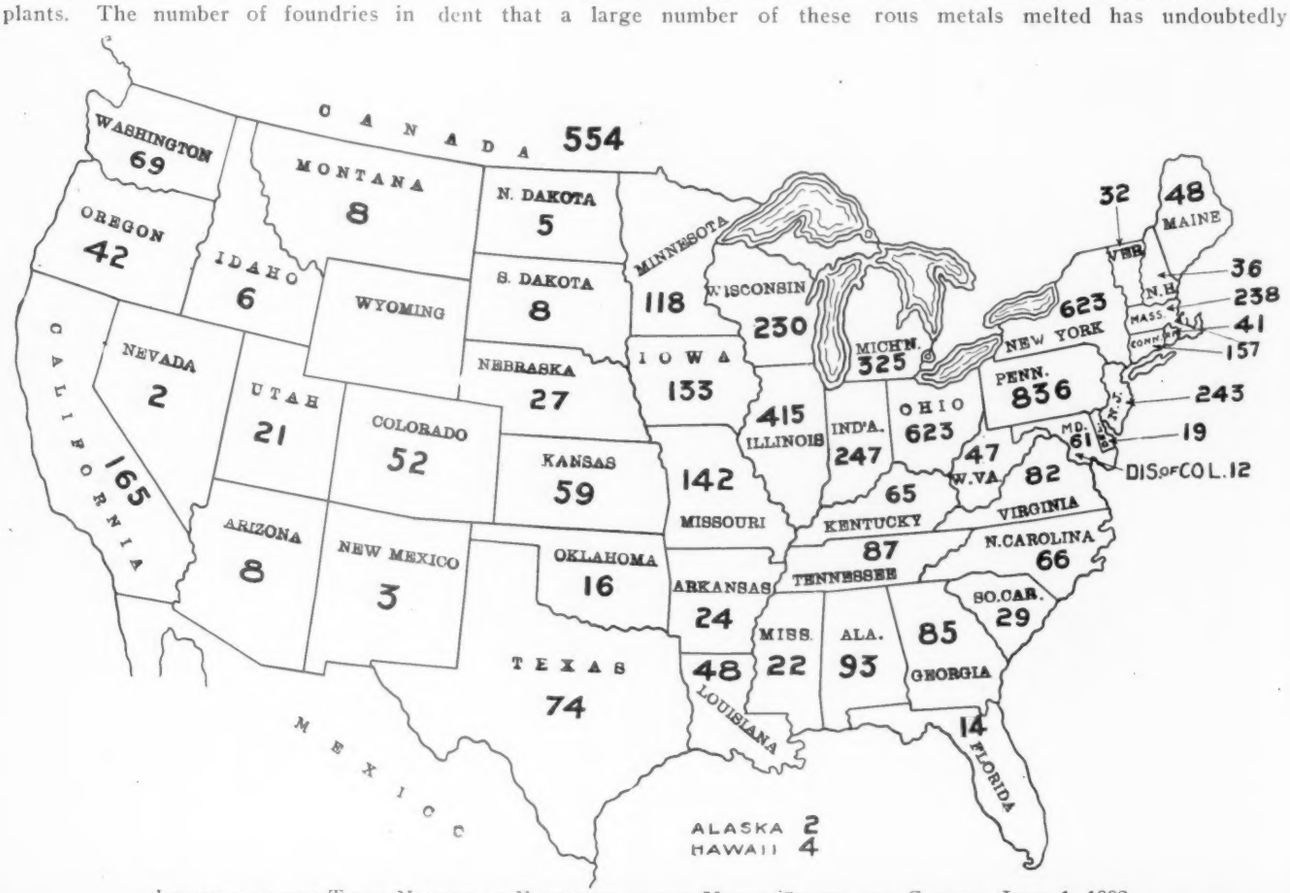
Just what may be the true explanation for this must be left for future investigation, but perhaps some light may be thrown upon the subject by the following: Experiments made by Mr. Fitzgerald at Niagara Falls, in treating molten iron with 1 per cent titanium, the bath of metal being 2,300 degrees Fahr., showed that the addition in question raised the temperature some 25 degrees for a minute, then slowly dropping to the original again. Evidently there was a reaction involving the giving out of heat. Possibly this may account for the long continued redness of the test bars cast in dry sand molds.

Further, it is well known that a burnt heat causes badly "skulled" ladles, the slight drop in temperature of what looks like highly overheated metal being sufficient to do this. Here is a case of raising the melting point of the metal through oxidation. Possibly by the addition of titanium, and the consequent removal of this oxidation or even of absorbed nitrogen, more particularly noticeable in steel work, the melting point is dropped again, and longer continued fluidity gives rise to the phenomenon above described.

While this cleansing action of titanium is exceedingly interesting to the iron founder, the producer of copper is really far more concerned. Titanium-copper alloy, when added to molten copper, deoxidizes it so rapidly that it is perfectly possible to make absolutely sound copper castings with a very small addition of titanium. The writer cannot present much along this line at present, but hopes to do more later. In the meantime the experiments with titanium and other alloys will be continued on behalf of the American Foundrymen's Association, and the results will be duly reported.

IRON, STEEL, MALLEABLE AND BRASS FOUNDRIES IN THE UNITED STATES AND CANADA

STATISTICS compiled by THE FOUNDRY from a careful canvass of the foundry industry of the United States covering a period of nearly two years, show a total of 5,812 iron, steel, brass and malleable foundries in the United States on June 1. As compared with the spring of 1906 this shows an increase of 217 plants. The number of foundries in Canada has increased from 513 in 1906 to 554, making a total for the United States and Canada of 6,366, a gain of 258 since the last figures were compiled. That the increase is not larger will undoubtedly prove a surprise to the trade, inasmuch as many new enterprises were projected in the last few years, although it is evident that a large number of these were not successfully carried out. Furthermore, the financial stringency of the past 12 months has retarded development, and the erection of numerous new plants is being held in abeyance until business conditions improve. Rebuilt plants and extensions do not show in these statistics, and while the amount of iron and non-ferrous metals melted has undoubtedly



LOCATION OF THE TOTAL NUMBER OF FOUNDRIES IN THE UNITED STATES AND CANADA, JUNE 1, 1908

increased enormously, nevertheless, no figures have yet been compiled which accurately show the tonnage converted into castings.

Location of Plants.

The accompanying charts graphically show the distribution of the casting establishments throughout the United States and Canada. The total number of iron foundries in the United States has increased from 4,488 in 1906, to 4,622, an increase in two years of 134. Canada now has 483 iron foundries, as compared with 468 in 1906, a gain of 15. There are now 5,105 iron foundries in the United States and Canada, as compared with 4,956 two years ago.

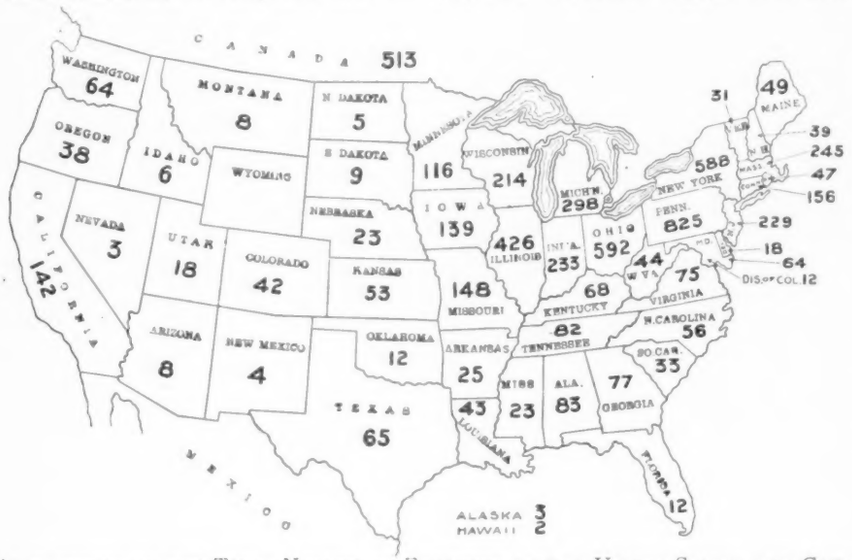
Foundries Melting Non-Ferrous Metals.

In compiling these statistics careful attention was given to securing accurate data regarding the plants melting non-ferrous metals exclusively. These include those casting aluminum, bronze, etc. These have been tabulated and have been termed exclusive brass foundries, of which there are 1,037 in the United States and 59 in Canada, as compared with 940 and 36 respectively, two years ago. The total in the United States and Canada is 1,096, against 976 in 1906. In addition there are many gray iron and steel foundries which operate small brass departments and including exclusive brass plants, there are a total of 2,799 establishments melting the non-ferrous metals in the United States at the present time, as compared with 2,432 two years ago. The total for the United States and Canada is now 3,001, against 2,582 in 1906.

	Total Foundries, 1906.	Total Foundries, 1908.	Increase in Total Foundries in Two Years.	Iron Foundries, 1906.	Iron Foundries, 1908.	Increase in Iron Foundries in Two Years.	Exclusive Brass Foundries, 1906.	Exclusive Brass Foundries, 1908.	Malleable Iron Foundries, 1906.	Malleable Iron Foundries, 1908.	Steel Foundries, 1906.	Steel Foundries, 1908.	Stove Foundries, 1908.
UNITED STATES—													
Alabama	83	93	10	75	86	11	5	6	1	1	3	3	11
Alaska	3	2	—1	3	2	—1	...	.....	...	...	...	...	...
Arizona	8	8	...	8	8	...	...	.....	...	...	...	...	...
Arkansas	25	24	—1	21	21	...	3	3	...	...	...	...	...
California	142	165	23	122	139	17	19	23	...	2	2	4	1
Colorado	42	52	10	40	44	4	2	8	...	...	2	2	...
Connecticut	156	157	1	90	88	—2	2	62	8	11	2	2	1
Delaware	18	19	1	11	11	...	5	4	1	1	3	4	...
District of Columbia	12	12	...	8	9	1	4	2	...	...	...	2	...
Florida	12	14	2	11	14	3	1	.....	...	...	...	...	...
Georgia	77	85	8	68	80	12	8	5	...	...	...	...	7
Hawaii	2	4	2	2	4	2	...	.....	...	...	...	...	...
Idaho	6	6	...	6	6	...	...	.....	...	...	...	...	...
Illinois	426	415	—11	332	334	2	73	63	17	20	10	14	24
Indiana	233	247	14	195	203	8	31	38	5	7	7	7	10
Iowa	139	133	—6	131	125	—6	7	7	1	1	...	1	1
Kansas	53	59	6	49	54	5	4	5	....	...	...	...	1
Kentucky	68	65	—3	59	55	—4	8	7	...	1	1	2	7
Louisiana	43	48	5	38	43	5	5	5	...	...	...	...	...
Maine	49	48	—1	39	38	—1	10	10	...	...	...	...	3
Maryland	64	61	—3	47	46	—1	16	15	2	1	1	1	4
Massachusetts	245	238	—7	165	163	—2	74	87	2	2	9	11	11
Michigan	298	325	27	230	244	14	64	69	7	8	5	10	8
Minnesota	116	118	2	99	99	...	14	16	1	1	3	3	2
Mississippi	23	22	—1	21	19	—2	2	3	...	...	...	...	1
Missouri	148	142	—6	119	122	3	13	29	3	4	3	2	4
Montana	8	8	...	8	8	...	...	.....	...	...	...	...	...
Nebraska	23	27	4	21	25	4	2	2	...	...	...	...	...
Nevada	3	2	—1	3	2	—1	...	.....	...	...	...	...	...
New Hampshire	39	36	—3	32	29	—3	7	7	1	1	...	...	2
New Jersey	229	243	14	165	166	1	58	68	5	5	7	11	2
New Mexico	4	3	—1	2	2	...	2	1	...	...	...	...	...
New York	588	623	35	457	462	5	122	147	15	18	10	15	27
North Carolina	56	66	10	56	65	9	...	2	...	...	...	...	...
North Dakota	5	5	...	5	5	...	...	.....	...	...	...	...	...
Ohio	592	623	31	441	454	13	128	137	15	21	16	28	38
Oklahoma	12	16	4	12	16	4	...	.....	...	...	...	...	...
Oregon	38	42	4	35	38	3	3	3	...	...	2	3	2
Pennsylvania	825	836	11	666	666	...	127	135	17	20	51	60	27
Rhode Island	47	41	—6	28	27	—1	16	12	1	1	1	1	1
South Carolina	33	29	—4	33	29	—4	...	.....	...	...	...	...	...
South Dakota	9	8	—1	9	8	—1	...	.....	...	...	...	...	...
Tennessee	82	87	5	75	77	2	6	9	1	1	1	1	15
Texas	65	74	9	59	68	9	6	6	...	...	...	...	...
Utah	18	21	3	16	20	4	2	1	...	...	...	...	...
Vermont	31	32	1	28	29	1	3	3	...	...	...	...	...
Virginia	75	82	7	75	82	7	...	.....	...	...	1	1	4
Washington	64	69	5	59	61	2	5	6	...	1	...	1	...
West Virginia	44	47	3	42	44	2	2	3	1	1	...	...	1
Wisconsin	214	230	16	172	182	10	27	28	12	13	10	13	6
Total in United States	5,595	5,812	217	4,488	4,622	134	940	1,037	116	142	150	202	221
CANADA—													
Alberta	4	4	...	4	4	...	...	.....	...	...	...	...	...
British Columbia	18	19	1	18	18	...	...	1	...	...	...	...	...
Manitoba	9	12	3	9	11	2	...	1	...	...	...	...	...
New Brunswick	24	25	1	20	21	1	4	4	...	...	...	...	1
Newfoundland	2	2	...	1	1	...	1	1	...	...	...	...	...
Nova Scotia	35	37	2	32	33	1	3	3	...	1	1	1	...
Ontario	307	339	32	280	294	14	20	36	8	9	3	5	20
Prince Edward Island	5	5	...	5	5	...	...	.....	...	...	...	...	...
Quebec	108	110	2	98	95	—3	8	13	1	1	2	3	2
St. Pierre et Miquelon	1	1	...	1	1	...	...	.....	...	...	...	...	...
Total in Canada	513	554	41	468	483	15	36	59	9	11	6	9	23
Total United States and Canada	6,108	6,366	258	4,956	5,105	149	976	1,096	125	153	156	211	244

FOUNDRIES IN THE UNITED STATES AND CANADA IN 1906 AND 1908

The malleable iron industry has shown a phenomenal growth within the past two years and the total number of plants has increased from 116 to 142. Canada in 1906 had nine malleable foundries, as compared with 11 total of 35. Illinois ranks third with a total of 415 and Michigan fourth with 325, a gain of 27. Indiana is fifth with 247, Massachusetts sixth with 238, New Jersey seventh with 243, and Wisconsin eighth with 230.



DISTRIBUTION OF THE TOTAL NUMBER OF FOUNDRIES IN THE UNITED STATES AND CANADA, 1906

at the present time. These figures likewise show a gain of about 35 per cent in the number of establishments producing steel castings. In 1906 there were 150 steel foundries in the United States, whereas at the present time there are 202, a gain of 52. Canada has nine at present as compared with six, two years ago. These figures include not only the plants manufacturing steel, by the open-hearth process, but those producing castings by the Bessemer and crucible steel processes as well. The total number of stove foundries in the United States is 221 and the total in the United States and Canada is 244, Canada being credited with 23.

These figures regarding the stove industry do not include the plants which buy their castings and merely assemble their stoves, as well as those producing steel plate ranges, air tight and other stoves of a similar nature in which the castings are merely used for ornamental purposes.

Leading Foundry Centers.

The relative position of the leading states in the foundry industry remains practically unchanged. Pennsylvania still leads by a wide margin, having 836 foundries as compared with 825 two years ago. Ohio and New York divide second honors with a total of 623, as compared with a total of 592 and 588, respectively, in 1906. New York shows the biggest gain, with a

Pennsylvania is credited with 666 iron foundries, and again leads by a margin of more than 200. New York ranks second with 462, Ohio third with 454 and Illinois fourth with 334. California, with a total of 165 foundries, of which 139 cast gray iron exclusively, shows the biggest gain among the iron foundries, no less than 17 establishments having been added in the last two years. The total gain in casting establishments in this state during this period is 23.

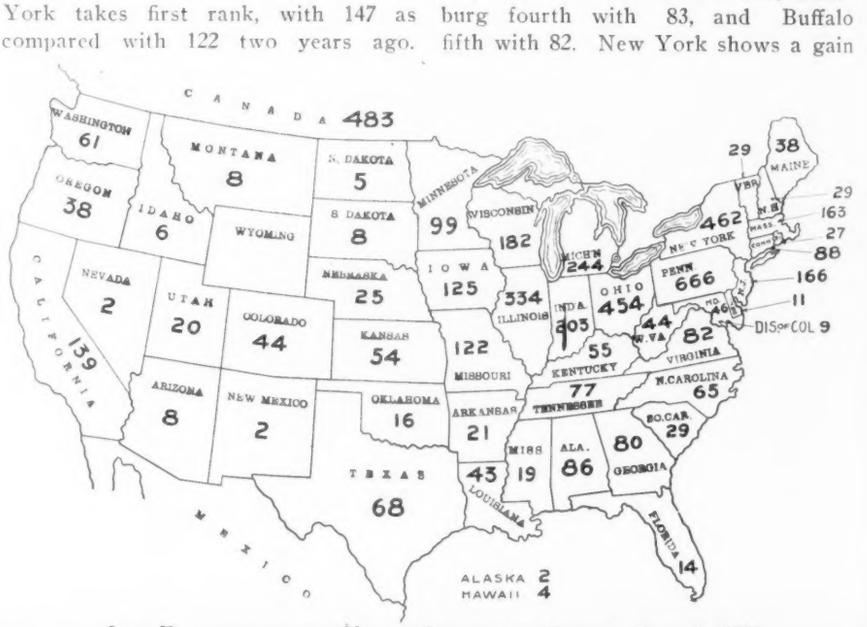
Brass Foundries.

In exclusive brass foundries New York takes first rank, with 147 as compared with 122 two years ago. The other states rank as enumerated: Ohio, 137; Pennsylvania, 135; Massachusetts, 87; Michigan, 69; Illinois, 63; Connecticut, 62. Both Connecticut and Massachusetts melt a large tonnage of copper, nevertheless, the number of gray iron establishments exceeds the exclusive brass in both states. In the total number of establishments melting the non-ferrous metals, including the exclusive brass foundries, Pennsylvania leads with a total of 362, New York ranking second with 323. Massachusetts is credited with 138 and Connecticut with 96.

Ohio leads in total number of malleable plants, being credited with 21, a gain of six in the last two years. Pennsylvania and Illinois rank second with 20 each, New York third with 18, and Wisconsin fourth with 13. In the total number of steel plants Pennsylvania leads by a wide margin, being credited with 60, Ohio with 28, New York, 15, and Illinois, 14. Ohio, however, shows the biggest increase in the number of establishments, showing a gain of 12. Ohio leads in the total number of stove foundries, being credited with 38, Pennsylvania and New York ranking second with 27 each, Illinois third with 24, and Tennessee fourth with 15. In Canada the province of Ontario has a total of 339 foundries, as compared with 307 two years ago, and Quebec ranks second with 110.

Leading Cities in the Foundry Industry.

Among the leading foundry centers Chicago takes first rank, being credited with 131 establishments producing castings from the various metals. Philadelphia ranks second with 119, New York third with 118, Pittsburg fourth with 83, and Buffalo fifth with 82. New York shows a gain



IRON FOUNDRIES IN THE UNITED STATES AND CANADA, JUNE 1, 1908

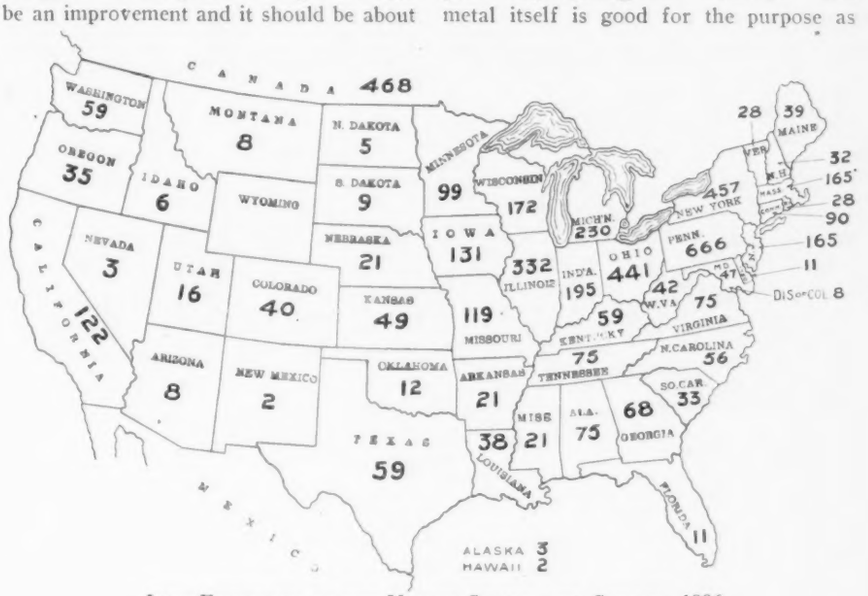
of 26 and Pittsburg 14. The leading foundry centers of the United States and Canada in the order of their rank are given below:

Chicago	131
Philadelphia	119
New York	118
Pittsburg	83
Detroit	82
Cleveland	81
Cincinnati	70
St. Louis	69
Buffalo	64
Milwaukee	58
Newark	50
San Francisco	48
Boston	45
Minneapolis	40
Baltimore	38
Toronto	37
Montreal	32
Indianapolis	31
Louisville	30
Birmingham	27

THIN BRASS CASTINGS.

Question:—We are experiencing considerable trouble with imperfections on the outer edges of our castings. They fail to run at points where they are exceedingly thin. Also advise us regarding the method of gating.

Answer:—Your difficulty is caused by the castings being too thin at the points where they fail to run. Here they are only 1-16 of an inch in thickness and do not taper to any extent. The best remedy is to build up the pattern by soldering on a strip of thin yellow brass. The vents of the casting submitted are taken off in the cope, one on either end, but none in the center of the casting. These vents are necessary as they prevent the air from becoming entrapped by the metal. They are, however, also open to objection, as they cause imperfections themselves, inasmuch as they are too large. Would suggest that you use a thin knitting needle through the cope distributing the small holes all along the top of the thin section. The gate is very clumsy. A rather heavy gate is necessary on the boss to prevent shrinkage, but on the thinnest portion of the casting there is heavy double gate. A thin gate at this point would be an improvement and it should be about ⅛ of an inch deep and 1 inch wide. The heavy center gate should be dispensed with and two broad thin gates should be substituted, the one nearest the boss being the broadest. Incline the molds and pour hot, rushing the metal in. The metal itself is good for the purpose as trolley fittings are always made of red brass and give the best service. K. K.



IRON FOUNDRIES IN THE UNITED STATES AND CANADA, 1906

PROLONGING THE LIFE OF CRUCIBLES*

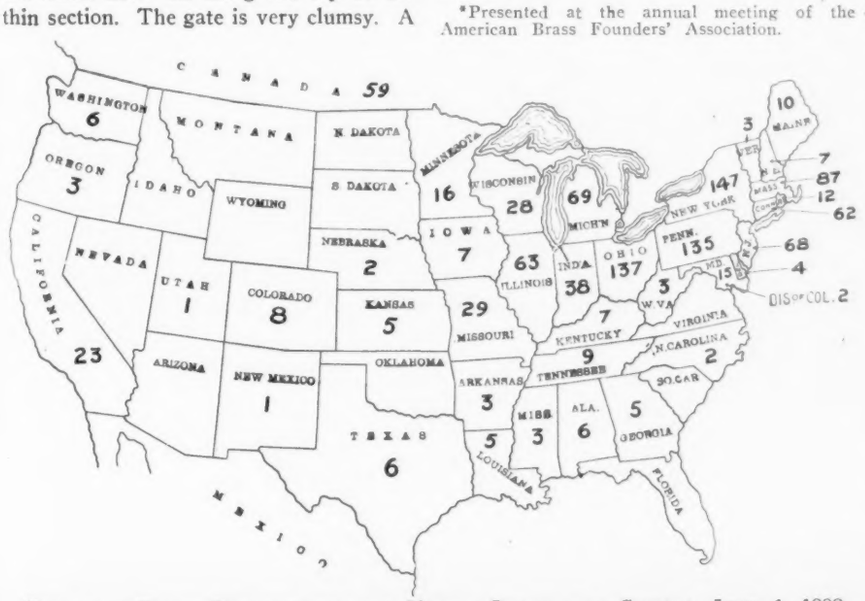
BY DUDLEY A. JOHNSON

ON THE one hand, the crucible maker works along the same lines as the manufacturing chemist or the druggist—that is, everything is analyzed, weighed and measured. He is not infallible and consequently makes mistakes.

On the other hand, crucible making is somewhat like bread making. Even if you have the proper formula, it does not follow that you will make good crucibles. A good method is for the crucible maker to keep a record of each batch of crucibles, say 500 pots made in one batch, at one time, by one man, precisely uniform in every respect, and these are sent out to 20 different customers. If 19 say: "Fine! send me some more of the same," and one man says "No good," we must conclude that the fault is in that man's shop. When complaints are received from practically every customer who gets a certain batch—the crucible maker knows he has made a mistake. The perfect system under which he works, and the long years of practice in repeating the same operation, reduce the chances of mistakes in his shop to a minimum. They are as 1 to 20 compared with causes of mistakes at the user's end of the line.

Too many brass foundries follow in the old ruts; they let their tongs and shanks get out of shape and don't notice any bad results; they leave their fuel out in the rain and don't think it makes any difference; they throw heavy ingots into the pot and jab it with an iron poker and the crucible seems to stand it all right. Gradually one bad practice after

*Presented at the annual meeting of the American Brass Founders' Association.



EXCLUSIVE BRASS FOUNDRIES IN THE UNITED STATES AND CANADA, JUNE 1, 1908

another creeps in, with the result that a complaint is made to the crucible maker that his pots are not as good as they used to be. The customer will say: "I can remember when we used to get 40 heats out of your pots and we can't get half that number now." It reminds one of the oldest inhabitant recalling the terrible winter we had back in the '60's.

MALLEABLE FOUNDRIES IN THE UNITED STATES AND CANADA, JUNE 1, 1908

Improvement in Crucible Manufacture.

Right here I want to say that the records will show that better crucibles are being made today than ever before in history. At first it may appear that this is a rash statement—some phenomenal runs are on the old record books—but it must be remembered that in the old days the pots used were much smaller than at the present. Crucibles Nos. 35 and 40 formerly were about the average sizes in use, while today Nos. 60 and 70 are nearer the average. Everybody knows that as the size increases the number of heats decreases. If 38 heats is the average on size 25, only about 30 heats would be expected on size 60, melting the same kind of metal. Another reason is that the mixture placed in the pot consisted almost exclusively of copper, tin, zinc and lead, whereas at the present time the crucibles are charged with metals that contain percentages of aluminum, manganese, phosphorus, nickel, etc. Various fluxes are also used, and all these things have a detrimental effect on the life of a crucible.

The average length of a heat used to be 2½ hours, whereas today it is not uncommon to get off a heat in 1½ hours, and frequently the metal is poured within 45 minutes after the pot is placed in the fire so that, if the crucible of today runs an even number of heats with one of 25 years ago, it must necessarily be a better pot to stand up under the more severe strain of a hotter fire to reduce the metal in half the time, and the injurious effects of various new ingredients which go into it. The records show a greater number of heats than in the old days, notwithstanding this severe usage.

Method of Prolonging the Life of Crucibles.

I am positive that a large percentage of the brass founders can increase the life of their crucibles materially if they will but follow up their shop practice, and in proof of this I want to cite an instance.

Several years ago, one of my friends in the trade happened to mention to me that on a No. 30 crucible his average heats were in the neighborhood of 25, and although he tried several makes of crucibles he did not get any better results; said he had heard other people speak of phenomenal records, but he was inclined to doubt their authenticity. I told him if he was not getting more than 25 heats out of a No. 30 pot melting this kind of metal, that there was something radically wrong and that by looking over his shop practice perhaps we might see where the trouble was.

We found in the first place that the furnaces which he was using were very wide and vary shallow. There were 6 to 8 inches of coke space on each side of the pot with about a 4-inch bottom under the pot. It was a natural draft furnace, and the air coming in from the grate bars below and passing up to the flue hole, carried the hottest part of the fire off to one side of the pot, with the result that the amount of fuel used was twice as much as necessary to melt the charge. I suggested a furnace that was narrower and deeper, allowing about 3 inches of coke space on each side of the crucible and 6 or 8 inches at the bottom. One furnace was built on this plan and the result was so satisfactory that all the rest were rebuilt.

Use of Larger Crucibles.

I also advocated the use of a larger crucible, as the most economical results are obtained by using the largest crucible that can be conveniently handled, consistent with the kind of castings to be poured. It is obvious that if you are making chandelier work, saddlery hardware, or very light castings of any kind, that a small crucible must be used, because the metal will cool in the pouring, but if heavier castings such as plumbing work or jobbing work is being poured, a larger crucible will be found more expedient, as all of the metal in the larger pot can be turned into the flasks before it is too cold to run properly, and the expense of melting the larger crucible is very little more than the small one.

Crucible Storage.

We then took up the matter of crucible

STEEL FOUNDRIES IN THE UNITED STATES AND CANADA, JUNE 1, 1908

storage. Two rooms were built with solid brick walls with gratings in the bottom and flues at the top, arranged so as to pass all the waste heat from the furnaces through these rooms on the way to the stack. One room was used for burning cores, the other was used for crucible storage, and dampers were placed so that the heat could be diverted into either of the two rooms as needed. This kept the crucible constantly at a high temperature and enough pots were always on hand so that they could be thoroughly seasoned before it was necessary to put them into use.

An improvement was noted in the life of the crucible, and we then turned our attention to the fit of the tongs. We had new tongs made of the grab pattern, an overhead trolley was used, and the pots were lifted out without any squeezing. Two pairs of tongs were used, one for the crucible when it was new, and another after it was partly worn out and had grown smaller. The shanks were overhauled and the clips discarded.

Records of Heats.

The keeping of an accurate record of the heats was next in order and also a record of the different furnace tenders, and it was found that some furnace tenders would require 25 per cent more crucibles and use 25 per cent more fuel in the same work than the man alongside. In order to discover whether the drafts of the furnaces or local conditions had anything to do with this difference, the furnace tenders were switched about, and ultimately it was proven that certain furnace tenders would constantly get at least 25 per cent better results than others from the same furnaces and under the same conditions. These men were gradually weeded out.

To sum up, we would say that at the last report this man has had a general average of 45 heats on a No. 50 pot over a period of nearly a year and a half, as against his old record of 25 heats on a No. 30 pot. We have not the figures on the fuel consumption, but are satisfied that he is using no more fuel with the larger crucible and under improved conditions than he was before.

I might give a number of other instances, but one will suffice. What has been done in one brass shop can readily be accomplished in another. I have here a list of the causes of the failures of crucibles, and I will briefly point them out.

Storage.

Crucibles should be stored in a warm, dry place, either back of the furnaces on the flues, where the hot gases from fresh fires will not strike them, or on the top of the core oven, but don't put them in the core oven where they come in contact with the moisture from the wet cores; or, if stored on top of the boilers, care should be taken to see that all steam pipes are tight and there are no leaks, and that they are away from the whistle which allows steam to escape. It is generally conceded that a crucible properly stored in a foundry is from 10 to 20 per cent more efficient at the end of a year. They season and solidify, and are away from the injurious effects of the damp air. The longer they are stored in the proper atmosphere the better.

STOVE FOUNDRIES IN THE UNITED STATES AND CANADA, JUNE 1, 1908

Annealing.

Before using, the crucible should be slowly brought up to a heat of 250 degrees Fahr., or over, but if this is accomplished too quickly a scalp is the result, or an internal fracture which will afterwards cause a leak. A No. 200 crucible requires about 10 hours to bring up to this heat. The pot should then be immediately filled with metal, and a heat taken off without allowing it to cool.

Fit of the Tongs.

The fit of the tongs is very important. On crucibles above size No. 50, tongs with double prongs should always be used, and preferably of the "grab" pattern. The upper prong prevents the pot from wobbling, and the "grab" device prevents squeezing. The tongs should grip the crucible below the bilge and lift it without undue pressure, as if it were in a shank or a basket. When a crucible is at white heat it is soft and leathery, and many crucibles are ruined by forcing the tongs together and pounding a ring on the handles. It is a great advantage to have two sets of tongs for every crucible; one for the new pot, and one for the pot half used which is smaller. The tongs should be "shaped up" at frequent intervals.

Shanks.

Shanks of the scissor pattern are hard on crucibles, because of the tendency to seize the pot too high up and squeeze it. The plain ring pattern shank is the best. The ring should be wide, and tapered to conform to the contour of the crucible. It is not necessary to use clips with this style shank.

Fuel.

The fuel should be dry. Wet coke produces moist gases and steam, which causes alligator cracks. Sulphur in the fuel shortens the life of the crucible materially. Twenty-five per cent more heats have been obtained by a change of fuel.

Position of the Crucible in the Furnace.

At the beginning of the heats, the top of the crucible should never set higher than the bottom of the flue-hole, and if the work will permit, the space around the pot and at the bottom should be sufficient to hold enough fuel to take off the heat without re-coking. A long narrow furnace is preferable to a short wide one.

Dampers.

The drafts and dampers, if arranged to produce a reducing atmosphere, will lengthen the life of the melting pot. An oxidizing flame is always unfriendly to a plumbago crucible.

Clinkers.

The clinkers should be removed from the sides of the pot as the tongs are put on, and from the bottom of the pot before it is set on the floor. It should always be set on a bed of dry sand; never on hard bricks.

Slag.

In melting scrap and dirty metal, the inside of the pot becomes thickly coated with slag, and this should be removed

with a scraper. It can easily be accomplished when the pot is hot. Then the crucible has more holding capacity, and the heat passes through it more readily.

Soaking.

It is bad practice to leave the metal on the fire after it is ready to pour; soaking in this way an extra half hour has a more injurious effect on the crucible than the entire previous heat.

Kinds of Metal.

The melter must not expect as many heats in melting one metal as another. From three heats in melting nickel, to five or six in melting steel; approximately 25 are reached in melting copper, while the heats run into the 40's in melting composition. If, when ordering your crucibles, you could give a hint to the maker as to what metal is to be melted, he would know better what crucible to send.

Flux.

Where it is necessary to use a flux to clean the metal, it must be expected that the life of the crucible will be shortened, as nearly all fluxes attack the binding material in the walls of the crucible to a greater or less extent.

Cooling Between Heats.

If the crucible can be recharged and put back into the fire at once, a greater number of heats will result than if it is set away and allowed to cool between each heat.

Length of Heat.

The time of the heat is also to be allowed for. If the heat is taken off in an hour or an hour and a half, the crucible will not last as long as with the lighter punishment of a two and two and a half hour heat.

Buttons.

Don't leave any metal to cool in the crucible, but pour until the melting pot is entirely empty. In the parlance of the shop, don't leave the crucible so that you will find a button in the bottom when it has cooled off. These buttons may have small threads or spikes of metal which will attach themselves to the crucible walls, and they tear the walls of the pot as they come out; or, if left in the crucible, when the next heat is taken off, they expand more rapidly than the walls and break the pot.

Wedging.

Be very careful not to allow the ingots to wedge in charging the crucible, but place them in loosely, or expansion will break the pot.

Furnace Bottoms.

See that the crucible has a good bottom to rest on in the furnace. Some foundries use brick for the crucible to set on after it settles down, and these bricks should be smooth and level. If they get on edge or are set cornerwise, the hot crucible full of metal settling down on them or on a hard piece of clinker will have a hole punched through the bottom. Remember there is a great deal of weight above the bottom of this leathery pot.

Poker.

Be very careful with the use of the poker, as it is an easy matter to punch a hole through a hot crucible.

In addition, we might say that it is important to always place the pot in the center of the furnace, so that there is an equal fuel distribution all around. It is also good practice to turn the pot partly around after each heat, that is, if the lip of the pot faces the flue-hole it should gradually be turned after each heat. This insures equal wear on all sides of the crucible.

CORE MAKING.*

By Archie M. Loudon

Core making is one of the most important branches of the art of founding, and yet for some understood reason, the getting of proper results is left to chance in a great measure. The core room should be familiar to every molder just as much as his floor, but he dreads it very much as it would seem.

Here is my experience with a variety of cores:

Radiator Cores.

These are safest and best made of bank or beach sand, mixed with oil in proportion of 1 part oil to 40 to 60 parts sand. Bake quickly until well browned. The result will be easily vented cores, and a ready extraction from the casting. This is important, as the work must be entirely clear of the core before testing.

Steam and Water Boiler Cores.

Use bank or beach sand with about 25 per cent mash, or, add floor sand to make the core stronger without having to use too much oil. The addition of oil is a particular matter and not readily controlled, for with too much oil the cores are more difficult to bake and become so hard that portions are left inside the castings, causing serious damage at times when these castings are used. The old sand helps the binding of the sharp sand, and as the castings are usually ⅜ of an inch thick, the oil is completely burned out, and the materials easily extracted. The mixture best suited for this class of work is 75 per cent sharp sand, and 25 per cent of old floor sand. Then take 1 part of oil to 50 or 60 of the sand mixture.

*Presented at the annual meeting of the American Foundrymen's Association.

Small Cores for General Use.

These are safest when made of the mixture for radiator cores, if the castings are to be light or medium in weight. Small cores for heavy castings should be made from a good strong fire sand and molding sand with a somewhat refractory binder such as flour and graphite. This is necessary to get a good clear hole in the casting.

Small cylinder cores should be made from an oil sand mixture. Similarly the barrel core, as there is less liability of blow holes from such cores than from any others known. Further, when the iron is machined a clean smooth surface is left for the tool. The iron is also liable to remain softer, hence this mixture should be used for port cores, exhaust and steam chest cores. Use straight beach sand and oil, in proportion of 1 oil to 40 to 60 parts sand.

For barrel cores about 20 per cent of coarse molding sand mixed with 80 per cent beach sand, with oil 1 to 50 of the sand makes an excellent open core. Use this on cylinders up to 10 inches diameter. When the section of the casting becomes heavier a stronger mixture is necessary.

Large Cylinders.

Large cylinders necessitate a strong but open mixture to obtain good results. Fire sand, molding sand, sharp sand, each 1/3. Mix with glue water, 2 pounds of glue in 3 gallons of water, the solution being brought up to the boiling point only. Use this glue water to 100 pounds of the sand mixture. Dampen the sand with additional water, it being understood that this is for large cylinder cores for immediate use, as well as dried molds in one form or another. The reason for using glue is that the difficulty from gases is reduced to a minimum.

Large Cores.

Large cores used for a variety of routine work must be made by the foundryman with the different sands and binders he has, and the mixtures varied to suit his needs. A variety of formulae will give equally good results. My preference is as follows: For ordinary cores, 1/3 coarse molding sand, 1/3 beach sand, and 1/3 old sand. Mix these and take 1 part of dry compound with 36 of the sand mixture.

Where the large cores should be strong, use 1/3 coarse molding sand, 1/3 fire sand, and 1/3 old sand, and for each 36 parts of the mixed sand use one part of dry compound, and ½ part flour. I mention this particular binder as it gives me the best results with the sands peculiar to my locality. Other binders, both liquid and dry, will go equally as well with the sands they are specially suited for.

EXPOSITION OF FOUNDRY EQUIPMENT

Extensive Exhibits of Molding Machines—Daily Heats in the Model Foundry—Meeting of the Foundry Supply Association

MACHINERY hall and the Process building in Exhibition Park, Toronto, where the exhibits of foundry supplies and equipment were displayed, were crowded throughout convention week with interested foundrymen from all sections of the United States and Canada. The exposition reflected the tremendous strides that have been made in the founder's art in the last 12 months and the advancement in molding machine practice has been nothing short of phenomenal. The operating exhibits were confined to Machinery hall, and the temporary building adjoining it was converted into a model foundry. It was equipped with a Baillot cupola and the blast was furnished by a steam turbine Sturtevant blower set. Both received their first introduction to the American foundry trade at this meeting and attracted much attention. Heats were made daily and the machine-made molds were cast, thus affording the foundrymen an opportunity of judging for themselves the effectiveness and value of the labor-saving devices shown.

A battery of crucible oil melting furnaces was also operated by the Monarch Engineering & Mfg. Co., and molds were poured with the brass mixtures melted. In the rear of Machinery hall the J. D. Smith Foundry Supply Co. operated a sand blast machine for cleaning castings, thus completing the entire sequence of foundry operations. Souvenir ash trays, patterns for which were furnished by the Russell & Erwin Mfg. Co., New Britain, Conn., from a design made by Chas. J. Caley, were cast and distributed. The patterns were mounted on a Tabor molding machine.

Considerable business was done by all the exhibitors, who were unanimous in reporting exceedingly bright prospects which would indicate an early business revival. Owing to the large attendance the exhibition did not close until Saturday night.

Foundry Supply Association.

A preliminary meeting of the Foundry Supply Association was held on Tuesday morning for the appointment of a nominating committee and for the consideration of new business to be disposed of before the close of the convention. A committee was also appointed to consider the amount to be paid by members for those in attendance at their exhibits above the two allotted by the association. This fee has heretofore been $15 and some of the members felt that this was excessive. Another meeting was held at the King Edward hotel on Thursday evening and the committee reported in favor of reducing this fee to $5 instead of $15. It was decided, before the close of the meeting, to draft a new constitution which is to be presented next year, and it was also voted that the members of the nominating committee be elected by ballot in open meeting instead of being appointed by the president as heretofore. Officers for the ensuing year were elected as follows: President, F. N. Perkins, Arcade Mfg. Co., Freeport, Ill.; vice presidents, John Hill, Hill & Griffith Co., Cincinnati; E. J. Woodison, Detroit Foundry Supply Co., Detroit; T. W. Pangborn, Thos. W. Pangborn Co.,

HAMILTON FACING MILL CO., LTD.

FREDERIC B. STEVENS

New York City; Geo. H. Wadsworth, Falls Rivet & Machine Co., Cuyahoga Falls, O.; secretary, Henry M. Lane, Cleveland; treasurer, J. S. McCormick, J. S. McCormick Co., Pittsburg; trustees (three years), J. S. Rayner, Carborundum Co., Niagara Falls, N. Y.; J. S. Smith, J. D. Smith Foundry Supply Co., Cleveland; A. O. Backert, *The Foundry*, Cleveland.

Two vacancies occurred on the board of trustees owing to the election of F. N. Perkins, president, and E. J. Woodison, vice president. These unexpired terms will be filled by E. H. Mumford, E. H. Mumford Co., Philadelphia, and J. H. Whiting, Whiting Foundry Equipment Co., Harvey, Ill.

The Exhibits.

ALBANY & NORTH RIVER MOLDING SAND CO., Albany, N. Y.—This concern furnished a portion of the sand used by the molding machine exhibitors and had a space fitted up as an office. A full line of samples of molding sands were shown.

AMERICAN CARBURETOR CO., Mt. Vernon, O.—Mold drying device shown in operation.

ARCADE MFG. CO., Freeport, Ill.—The exhibit made by this concern was extensive and included "Modern" molding machines Numbers 1, 2 and 3. The latter is a new machine similar to Numbers 1 and 2, except that it is provided with an arrangement for making the cope on one side of the frame of the machine and the drag on the other. The new rock-over machine described in the June issue of THE FOUNDRY attracted considerable attention. This machine is equipped with a pair of equalizing bars to receive the flask when it is rolled over and an automatic device for locking the equalizer before the pattern is

MONARCH ENGINEERING & MFG. CO.

WHITING FOUNDRY EQUIPMENT CO., S. OBERMAYER CO., DOMINION FOUNDRY SUPPLY CO., LTD.

drawn. This machine has an especially high lift for drawing deep patterns. Another exhibit consisted of a dummy for use in ramming up copes. The new automatic molding machine recently placed on the market was shown in operation. A large number of sample castings made on the molding machine manufactured by this concern were also shown.

AUTO SAND MIXER, Piqua, O.—This concern had a machine in operation cutting sand.

BAIRD & WEST, Detroit.—This booth was attractively decorated and contained samples of by-product coke for foundry use.

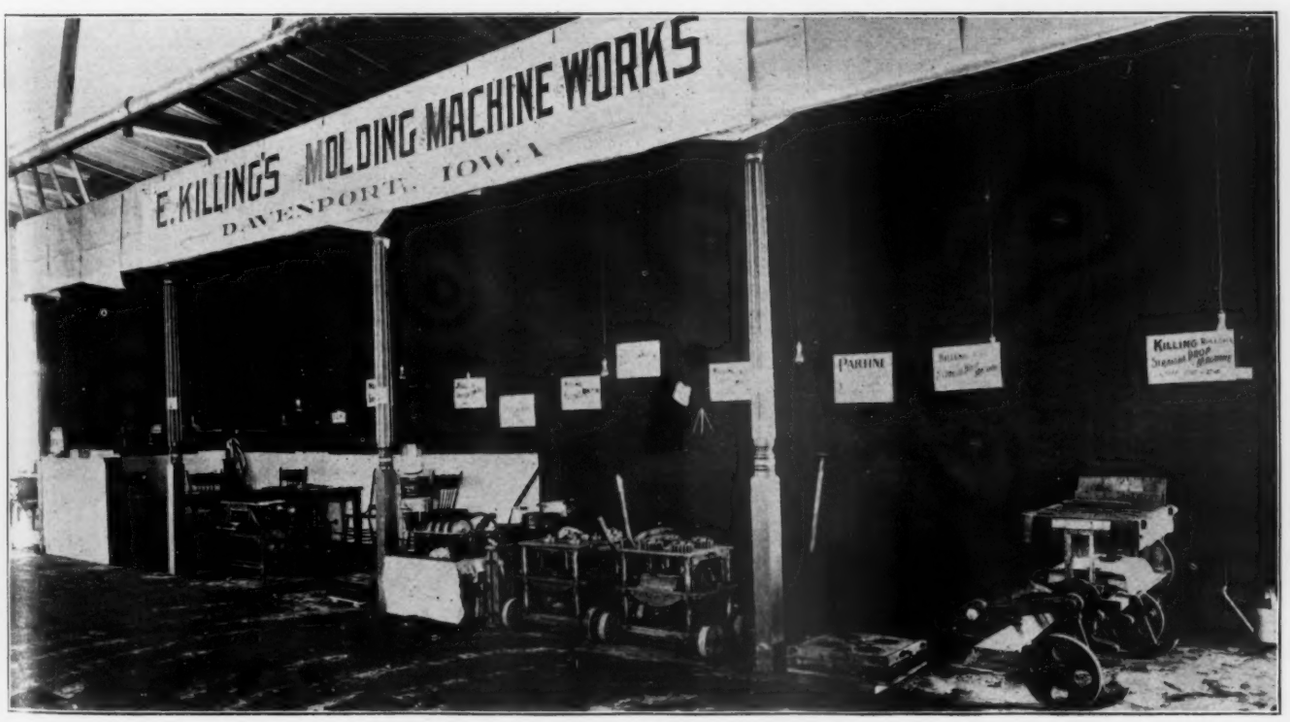
BALLOU'S WHITE SAND CO., Millington, Ill.—The exhibit of this concern was made in the booth of the Hamilton Facing Mill Co., Hamilton, Ont., and included various grades of foundry sands, such as natural magnesia core sand, white, washed silica furnace sand, fire and silica molding sand, sand blast, silica core, steel casting and yellow silica sand. The natural magnesia core sand was used on the core machines shown by the Falls Rivet & Machine Co., Cuyahoga Falls, O.

BARTLEY, JONATHAN, CRUCIBLE CO., Trenton, N. J.—This space was fitted up as an office and photographs were shown of the large crucible plant which this concern now has under construction.

BATTLE CREEK INTERIOR FINISH CO., LTD., Battle Creek, Mich.—Sand sifter displayed in the booth of the Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

BERKSHIRE MFG. CO., Cleveland.—The latest improved Berkshire machine was shown in operation and various patterns were mounted to demonstrate the adaptability of this machine to various classes of work. Souvenir paper weights were molded and were later cast in the annex.

BUCH'S, A., SONS CO., Elizabethtown, Pa. —This concern, together with the Mitchell-Parks Mfg. Co., St. Louis, and the Ontario Wind Engine & Pump Co., Toronto, had a combined molding machine exhibit, including the gravity molding machine and the new Mitchell-Parks portable molder. Large molds



E. KILLING'S MOLDING MACHINE WORKS

ARCADE MFG. CO.

were made on the gravity machine, which has a combined jarring and squeezing action for compressing the sand in the mold. A jib crane was used to handle the heavy molds and every arrangement was made to show the equipment under actual operating conditions.

BUFFALO FORGE CO., Buffalo.—The exhaust fan that was used for removing the dust from the polishing wheels in the exhibit of the Osborn Mfg. Co., Cleveland, was furnished by this concern.

CALUMET ENGINEERING CO., Harvey, Ill.—This concern displayed a model of the Calumet cupola which clearly showed the tuyere arrangement. The Calumet air hoist, which is extremely simple in construction, was also shown, as well as a turntable and other small equipment. A large number of photographs and blue prints of the equipment made by this concern were also displayed.

CANADIAN MACHINERY, Toronto.

CARBORUNDUM CO., Niagara Falls, N. Y.—In the center of the exhibit made by this concern was shown a large pyramid of carborundum as it is received from the electric furnace. The material made from this abrasive included grinding wheels, stones, carborundum paper, etc.

CASTINGS, Cleveland.

CLERCY, J. DE, Montreal.—The A. Baillot cupola which furnished this metal to the exhibitors, was installed by this concern. This cupola utilizes a large portion of the heat from the waste gases by returning a part of the gas, mixed with fresh air, to the tuyeres. Practically all flame and sparks were prevented from passing out of the cupola by a special spark arrester installed on top of the stack.

CLEVELAND TUMBLING BARREL & MFG. CO., Cleveland.—Two tumbling mills were shown in operation, provided with a special exhaust.

A VIEW OF THE FOUNDRY IN THE ANNEX, SHOWING STURTEVANT TURBINE CUPOLA BLOWER SET AND A. BAILLOT CUPOLA.

ROBESON PROCESS CO.

CLEVELAND WIRE SPRING CO., Cleveland.—This concern showed metal factory boxes and trays, barrels, etc., as well as trucks provided with factory barrels.

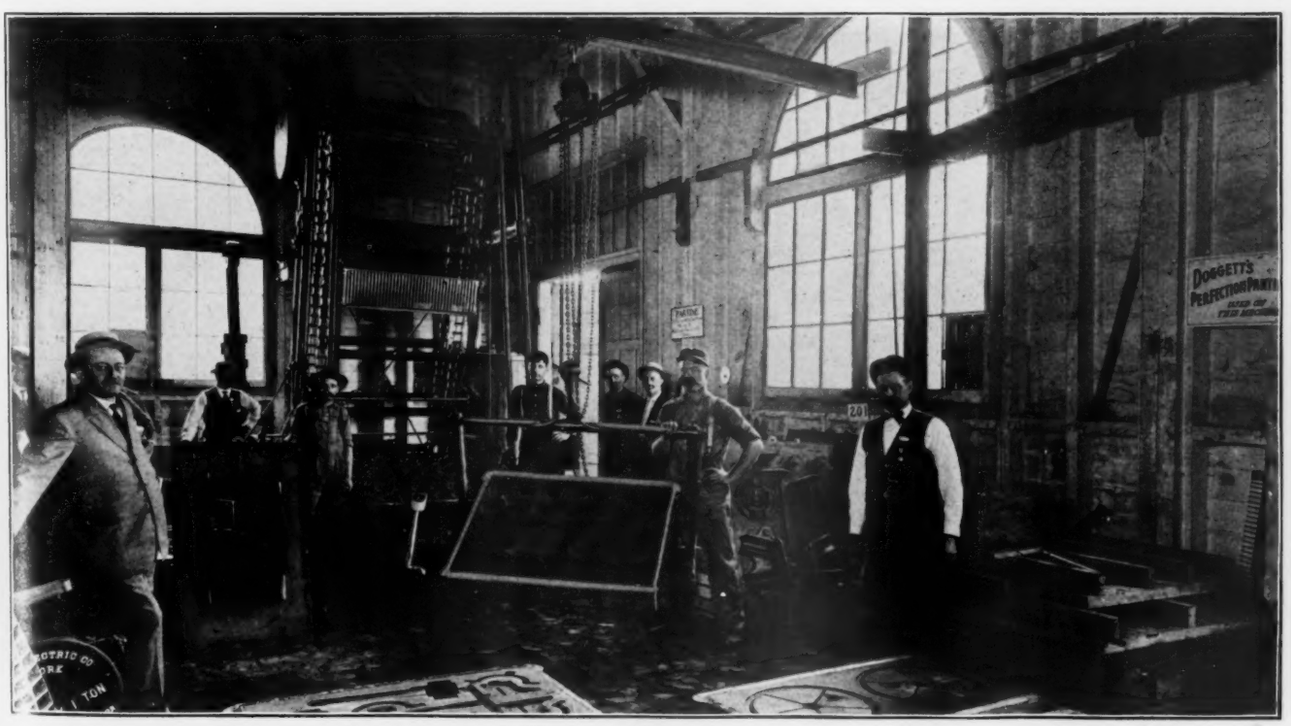
DETROIT FOUNDRY SUPPLY CO., Detroit.—The exhibit made by this concern was unusually attractive and included a Woodison oil melting furnace, sprue cutter, snap bench, metal snap flasks, Webb molding machine and a full line of small foundry equipment.

DETROIT TESTING LABORATORY, Detroit.—The iron melted in the cupola was tested by this concern, in whose booth were shown a testing machine and several other pieces of apparatus used by chemists and engineers.

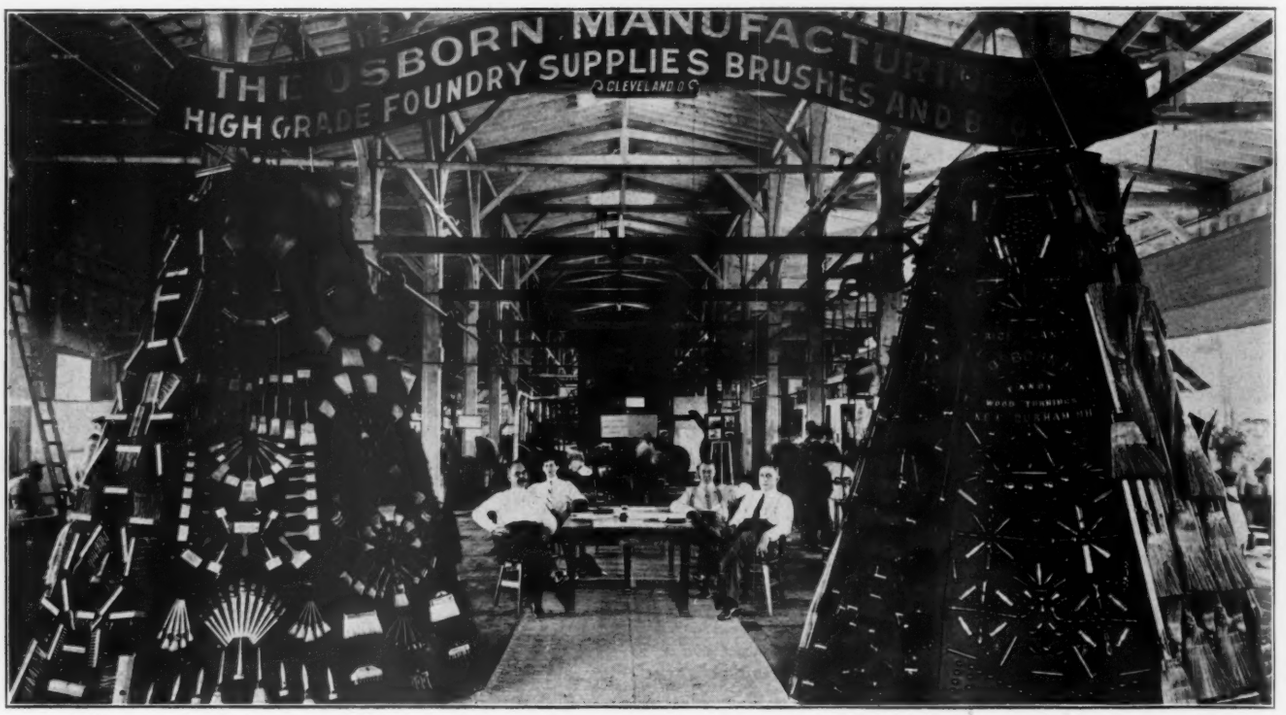
DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—The "old soldiers," as the used crucibles are styled, shown by this concern, attracted considerable attention. This exhibit also included new crucibles of various kinds for melting steel and non-ferrous metals.

DOGGETT, STANLEY, New York.—Perfection compound and complete line of foundry facings, as well as metal workers' soapstone crayons and pencils used by structural iron and steel concerns as well as by foundrymen. Samples of "Fill-it" iron and steel cements for foundry use were also exhibited in this booth by the Doggett Mfg. Co., New York. A. J. Johnson, the midget of the show, was in charge of this exhibit and gave demonstrations of the use of Perfection compound. Souvenir chirpers were distributed and were much in evidence on the lake ride.

DOMINION FOUNDRY SUPPLY CO. LTD., Montreal.—The exhibit of this concern, as well as that of the S. Obermayer Co., Cincinnati, and the Whiting Foundry Equipment Co., Harvey, Ill., were confined in one booth, which included a display of the complete line of



A. BUCH'S SONS CO.



OSBORN MFG. CO.

foundry equipment handled by this Canadian concern.

DOMINION IRON & STEEL CO., Sydney, N. S.—This concern furnished free of charge a carload of machine cast pig iron for use in the cupola.

FALLS RIVET & MACHINE CO., Cuyahoga Falls, O.—The complete line of core room equipment built by this concern was attractively displayed in the booth of the Hamilton Facing Mill Co., Hamilton, Ont., and included Wadsworth core machines, core cutting-off and coning machines, core ovens, and two cabinets of standard core prints which were shown in 33 different sizes, the two cabinets containing 624 prints. All of these prints are given a standard taper of 10 degrees. The range of sizes follows: One-half to 2 inches, 2 dozen of a size; 2⅛ to 4 inches, 1½ dozen of a size; 4¼ to 6 inches, 1 dozen of a size.

FOUNDRY, THE.—Cleveland.

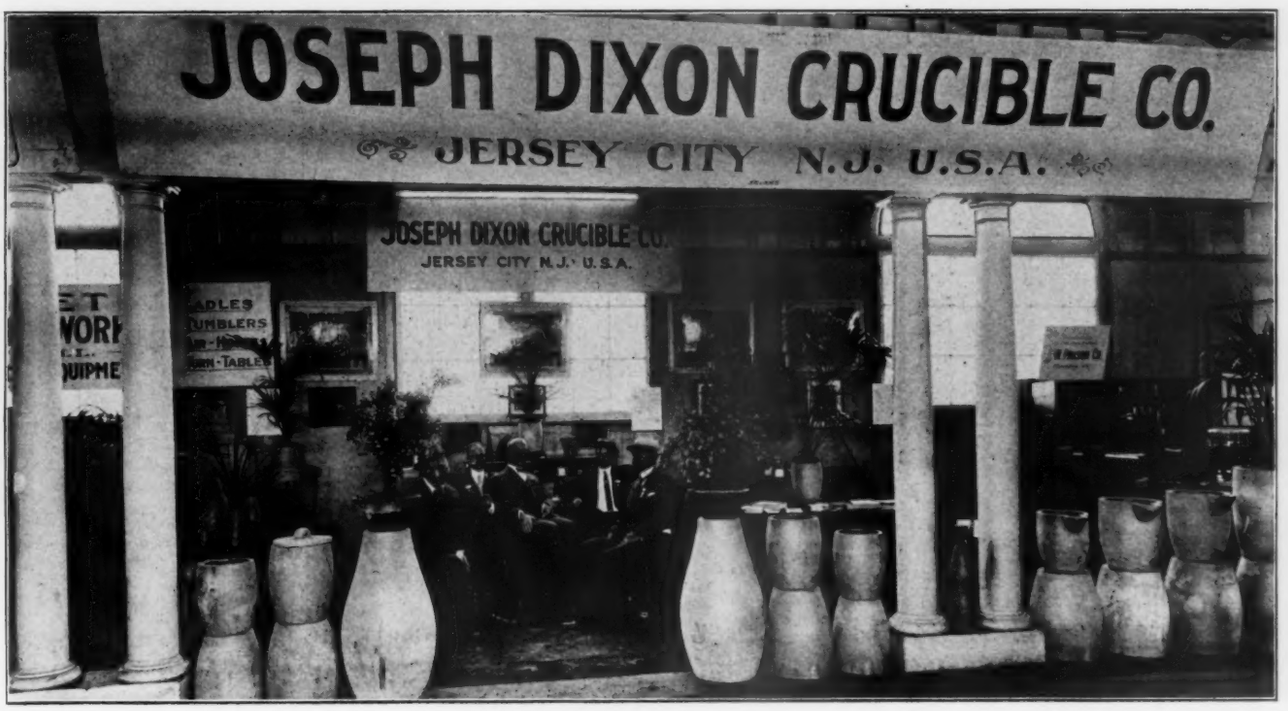
FOUNDRY SPECIALTY CO., Cincinnati.—"Fluxine" and "Partine," the former used as a flux for non-ferrous metals and the latter as a parting compound, were shown by this concern in the booth of the Hamilton Facing Mills Co., Hamilton, Ont.

FOX MACHINE CO., Grand Rapids, Mich.—Complete line of pattern shop equipment, including Fox wood trimmers, core box machine, and a large core box which showed the capacity of this machine.

GENERAL ELECTRIC CO., Schenectady, N. Y.—Curtis steam turbine blower set capable of developing a pressure of four pounds to the square inch. This blower was operated and attracted considerable attention.

GOLDSCHMIDT THERMIT CO., New York.—Demonstrations of the use of thermit were made daily in the space reserved by this concern. Appliances were shown for welding

HENRY E. PRIDMORE



JOSEPH DIXON CRUCIBLE CO.

iron in sections, butt-welding pipe and repairing castings. Titanium-thermit cans for purifying iron and steel and semi-steel cans for reviving dull iron and melting steel borings in gray iron for the purpose of making semi-steel castings were also displayed.

GREGG MFG. CO., Cleveland.—The Gregg automatic core wire straightening and cutting-off machine was shown for the first time at this meeting. This machine straightens the wire and automatically cuts it to length.

HAMILTON FACING MILL CO., LTD., Hamilton, Ont.—This was the "Made in Canada" exhibit, and the booth, which faced the band stand in the Process building, was the largest reserved by any of the exhibitors. In it were represented all of the manufacturers represented by this concern in Canada and included the following: The Falls Rivet & Machine Co., Cuyahoga Falls, O., complete line of core room equipment; Battle Creek Interior Finish Co., Ltd., Battle Creek, Mich., the Battle Creek sand sifter; Reid Foundry & Machine Co., Ingersoll, Ont., the Reid hand-rammed stripping plate molding machine; Foundry Specialty Co., Cincinnati, flux for non-ferrous metals and parting compound; "Smooth-On" iron cements, Smooth-On Mfg. Co., Jersey City, N. J.; John C. Knoeppel's patent cupola tuyeres; Sheldons, Ltd., Galt, Ont., blowers. Samples of Canadian molding sand were also shown, as well as a full line of facings made by this concern. Samples of sand mixed by the Garden City Sand Co. and by Ballou's White Sand Co., Millington, Ill., completed this exhibit. The booth was handsomely draped and was constantly crowded with foundrymen from Canada and the United States.

HAWLEY DOWN DRAFT FURNACE CO., Chicago.—Complete line of Schwartz metal melting and refining furnaces, in sizes ranging

W. W. SLY MFG. CO.

DETROIT FOUNDRY SUPPLY CO.

from 300 pounds per heat up to the largest size, which has a capacity of 12,000 pounds. This exhibit also contained a complete line of castings—brass, bronze, aluminum, iron and steel, from metal melted in these furnaces by various users throughout the United States. Two of the furnaces were shown in operation under pressure, but no metal was melted.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—A jarring molding machine, 24 x 45 inches, provided with a complete turn over arrangement for drawing patterns, was shown in operation. This machine is well adapted for jobbing work and is of the plunger type. An aluminum model, fitted with an 8 x 8-inch table, was also operated. Demonstrations were made by a 15-year-old girl to show the simplicity of the operation of this machine.

HILL & GRIFFITH CO., Cincinnati.—The exhibit of this concern was made jointly with that of Francis Hyde & Co., Montreal, and contained a Blodgett core oven, as well as the Hill & Griffith snap bench and a full line of perforated chaplets.

HOLDEN, N. J., CO., LTD., Montreal.—The exhibit of the Chicago Pneumatic Tool Co. was made by this concern and included an air compressor which furnished the compressed air for the various pneumatic molding machines and a complete line of pneumatic rammers, chipping hammers, drills, etc., were also shown.

HOLLAND LINSEED OIL CO., Chicago.—Souvenir match holders were made from cores in which the Holland core oil was used as a binder. These cores were baked in the core oven operated by the J. D. Smith Foundry Supply Co.

HYDE, FRANCIS, & CO., Montreal.—The exhibit of this concern was made jointly with that of the Hill & Griffith Co., Cincinnati, and

STANLEY DOGGETT

WESTERN FOUNDRY SUPPLY CO.

J. S. McCormick Co.

contained a Blodgett core oven, steel charging baskets, crucibles, and the King molding machine.

INTERSTATE SAND CO., Cleveland.—This concern donated a carload of molding sand used by the exhibitors.

KILLING'S, E., MOLDING MACHINE WORKS, Davenport, Ia.—This concern displayed a new rock-over molding machine in two sizes, as well as a pair of standard stripping plate machines fitted up for making gear patterns and another machine for making pulleys, car wheels, etc. An electrically driven universal saw table was also shown, as well as automatic flasks, steel jackets, etc.

KOPPEL, ARTHUR, CO., Pittsburg.—This concern showed a very interesting model of the construction of standard industrial track systems, together with cars of various types.

KNOEPPEL, JOHN C., Buffalo.—Patent continuous cupola tuyeres shown in the booth of the Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

KROESCHELL BROS. CO., Chicago.—The Kroeschell-Schwartz gyrating flame crucible furnace for melting non-ferrous metals.

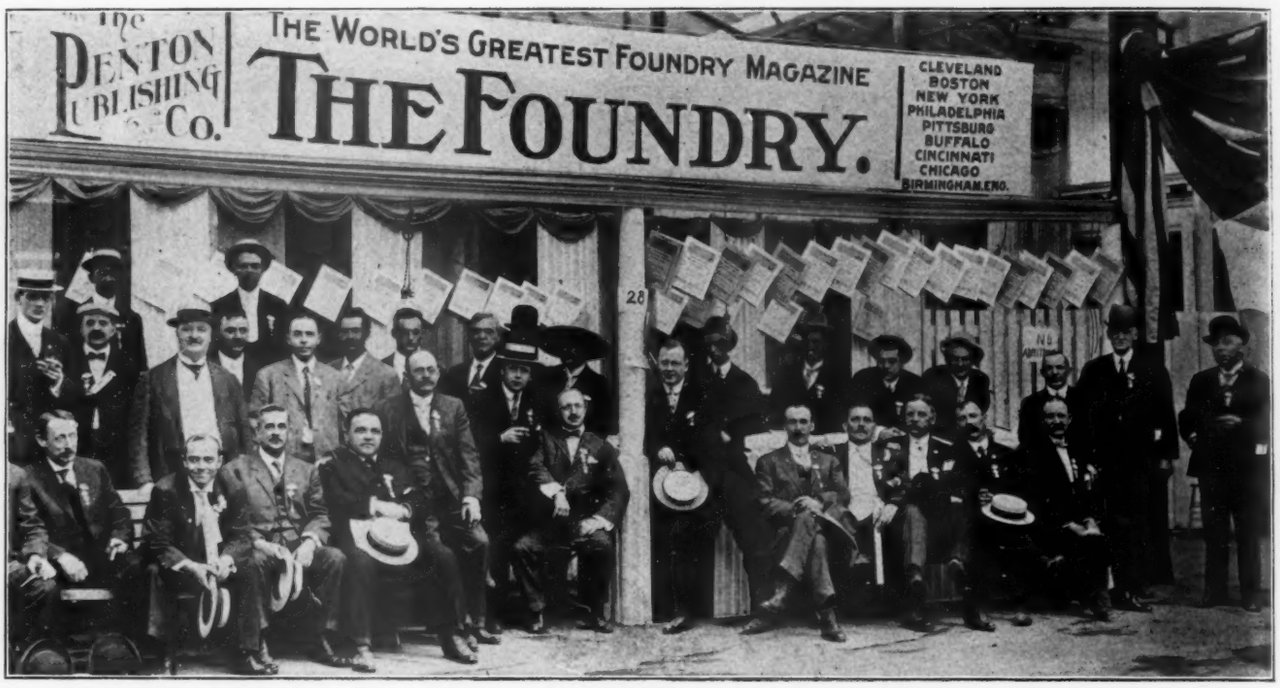
LINDSAY, W. W., CO., Philadelphia.—Complete line of chaplets for foundry use.

MITCHELL-PARKS MFG. CO., St. Louis.—The new Parks portable molder, which is a combined jarring and squeezer molding machine.

MONARCH ENGINEERING & MFG. CO., Baltimore.—This concern had a complete working exhibit and operated a No. 6 Monarch low pressure blower driven by an 8-horse-power electric motor. The other exhibits included ladle heaters, Steele-Harvey crucible brass melting furnace, improved lifting-out crucible type of furnace with a pipe attachment, one regular Steele-Harvey non-tilting furnace, one soft metal pot furnace for melting lead and tin, and one rivet heating furnace. The non-ferrous metal cast in the annex was melted in these furnaces.

Jonathan Bartley Crucible Co.

Cleveland Wire Spring Co.



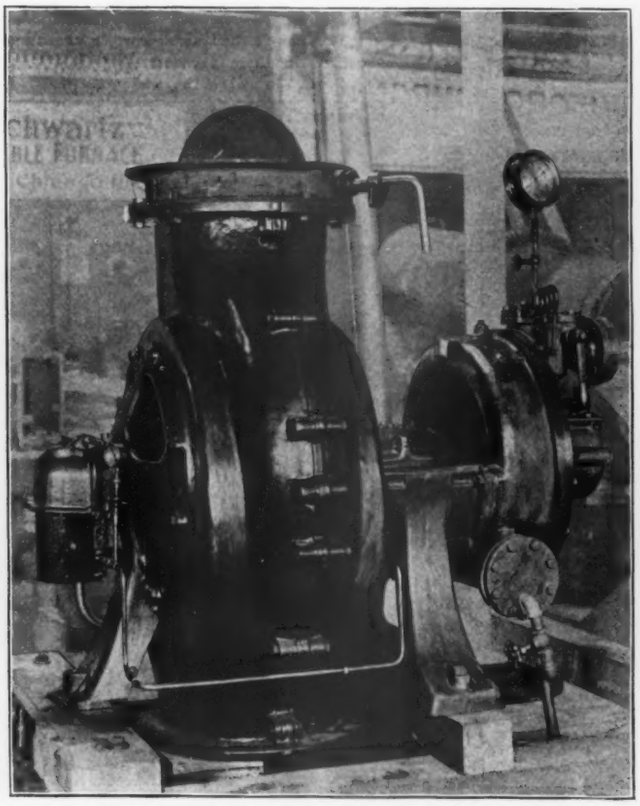
THE FOUNDRY

MUMFORD, E. H., CO., Philadelphia.—A French sand mill manufactured by Ph. Bonvillain & E. Ronceray, Paris, France, was shown in operation, mixing and blending molding sands. This exhibit also included one R-3 French molding machine with pump and accumulator and demonstrations were given of making French stripping plates. A split pattern molding machine of the Mumford type was also shown.

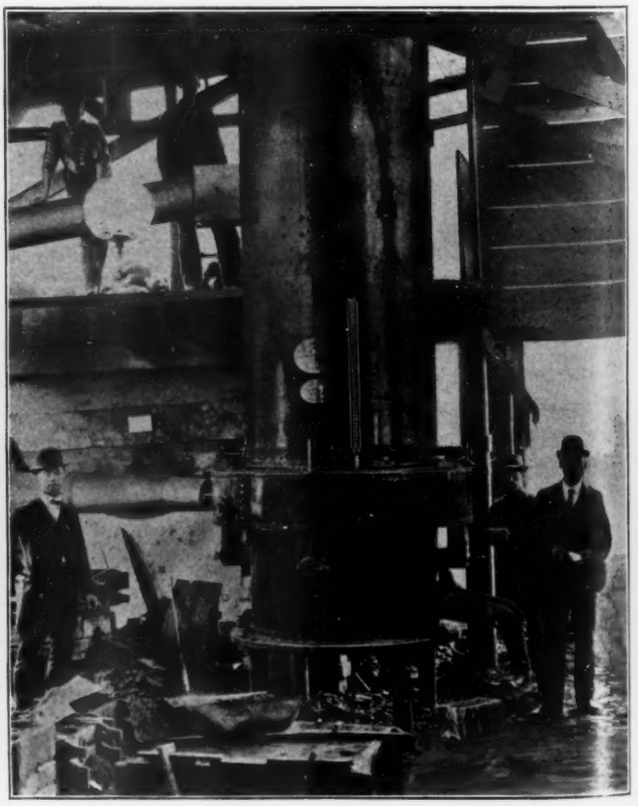
McCORMICK, J. S., Co., Pittsburg.—The McCormick roadster shown in this booth attracted considerable attention. The wheels were made of mallets, the large sprocket consisting of a riddle and the small sprocket, a spray can. The chain was made of rapping plates and the hubs were circular wire brushes. The uprights of the frame were made up of bench rammers and the balance of the frame consisted of floor rammer handles. The handle bars consisted of round wire brushes and a bellows was used as a seat. A torch was used as a headlight and the mud guard was made of a wire brush. The bicycle was locked with chaplets and leather fillet. This exhibit also contained a display of molders' tools, Farnham sand blast, exhaust tumbling barrels, Millett core oven, and an assortment of hand ladles.

NORCROSS MOLDING MACHINE CO., Terre Haute, Ind.—This concern displayed castings made on the Norcross jar ramming molding machine.

NORTHERN ENGINEERING WORKS, Detroit.—This booth was decorated with photographs of a variety of Northern cranes, espe-

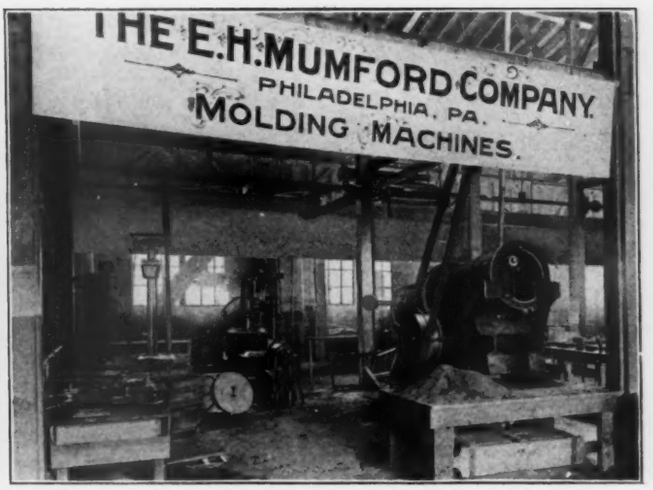


GENERAL ELECTRIC CO.'S STEAM TURBINE BLOWER SET



THE A. BAILLOT CUPOLA

GOLDSCHMIDT THERMIT CO.



E. H. MUMFORD CO.

cially three and four-motor electric traveling cranes, Newten cupola, and various types of foundry ladles, core oven equipment, foundry elevators, tumbling barrels, electric hoists, etc.

OBERMAYER, S., CO., Cincinnati.—This concern, together with the Whiting Foundry Equipment Co. and the Dominion Foundry Supply Co., confined its exhibits to one booth which was advertised as the home of "The Big Three." Samples of foundry supplies manufactured by this concern were shown, as well as an overhead trolley system which covered the entire booth, made by the Whiting Foundry Equipment Co. This showed the construction of the switches, turntables, hangers and other devices used in connection with systems of this kind. A pneumatic hoist was suspended from the trolley. Other small equipment, consisting of shovels, ladles, etc., was also schown, as well as photographs showing the installation of this foundry equipment in plants throughout the country. The "Esso" perforated chaplets were also displayed.

OSBORN MFG. CO., Cleveland.—The exhibit of this concern faced the main entrance to Machinery hall and at each side of the booth was erected an eight-sided pyramid covered with samples of the products made by this company. These include brushes, brush wheels, etc. The other exhibits included shovels, riddles, rammers and two grinding stands were also installed in this booth for polishing souvenir castings.

PAXSON, J. W., CO., Philadelphia.—Samples of foundry supplies, wire and bristle brushes, riddles, bellows, rammers, tongs, wax tapers, clamps, chaplets, core brushes, pattern-makers' supplies, etc., were handsomely displayed in a large cabinet. A magnetic metal separator was also shown in operation, separating iron from brass turnings. This exhibit also contained a No. 3 Paxson fan blower, which furnished blast for the Paxson pennant. Other features of this exhibit included aluminum pattern plates, knee pads, vibrators, blow valves, tub vibrators, pneumatic suction cleaners, and the Paxson rock-over molding machine for making stove plates.

PRIDMORE, HENRY E., Chicago.—A complete line of molding machines made by this concern were shown in operation including one small rock-over drop machine, fitted for molding pulleys; one small molding machine fitted for molding tees; one small rock-over machine fitted up for molding hollow ware, and two square stand machines fitted up for molding gears.

REID FOUNDRY & MACHINE CO., Ingersoll, Ont.—Hand rammed stripping plate molding machine shown in the booth of the Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

ROBESON PROCESS CO., Au Sable Forks, N. Y.—This booth faced the band stand in the Process building and was surrounded with a border of spruce trees from which the core binder manufactured by this concern under the trade name of "Glutrin" is made. This binder is a by-product of the paper pulp mills. Glutrin was shown in bottles, as well as spruce chips.

ROOTS, P. H. & F. M., CO., Connersville, Ind.—This concern exhibited a cupola blower as well as models of both blowers and pumps.

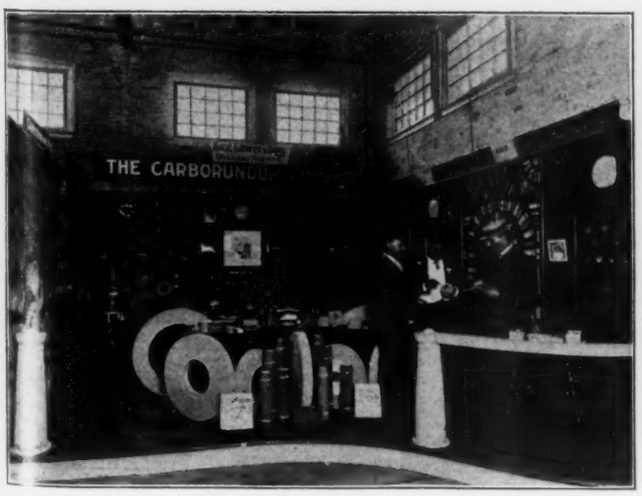
SEIDEL, R. B., Philadelphia.—Brass and steel foundry crucibles, ladle stoppers, etc.

SMITH, J. D., FOUNDRY SUPPLY CO., Cleveland.—The stationary core oven fitted with five rolling drawers operated in the annex to Machinery hall was installed by this concern. A sand blast machine was also operated, as well as two new types of sand riddling machines.

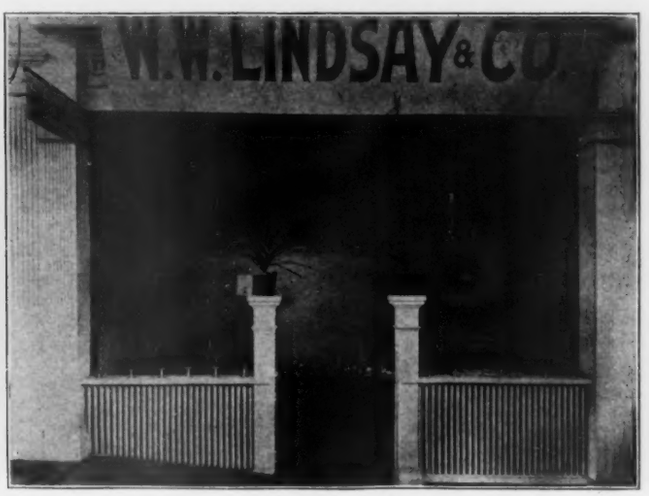
SMOOTH-ON MFG. CO., Jersey City, N. J.—The exhibit of this concern was made in the booth of the Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

SLY, W. W., MFG. CO., Cleveland.—New gear cutter for pattern shop use; resin and cleaning mills, dust arrester, friction clutch pulley and other foundry equipment. One of the tumbling mills was used for cleaning castings made in the foundry.

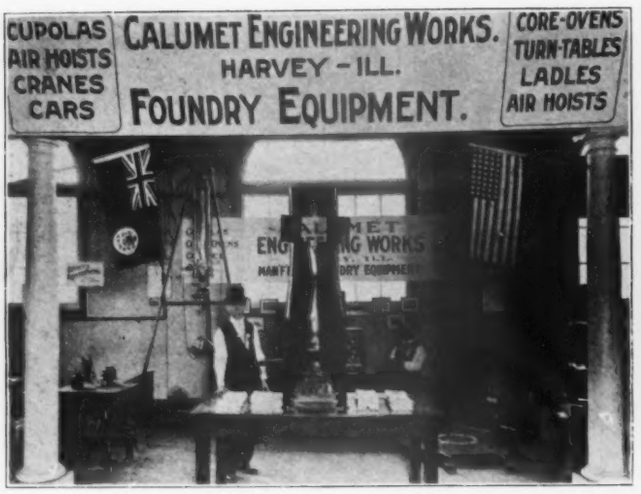
STANDARD SAND & MACHINE CO., Cleveland.—This exhibit included one portable automatic mixing plant used for mixing foundry sand, and is especially adapted for mixing loam; one No. 4 standard continuous mixer, equipped with an oil heater and an oil meter, as well as a spraying attachment for mixing sand for oil cores; two batch



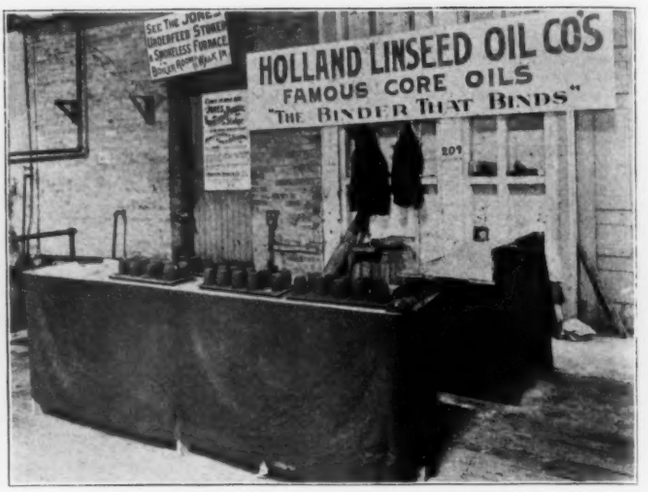
CARBORUNDUM CO.



W. W. LINDSAY & CO.



CALUMET ENGINEERING WORKS



HOLLAND LINSEED OIL CO.

mixers; one direct motor driven portable centrifugal mill for cutting over sand on floors; one upright stationary sand mill; one stationary centrifugal mill; one direct motor-driven foundry screen, fitted with a lever for adjusting the pitch of the screen and a section of a belt conveyor.

STEVENS, FREDERIC B., Detroit.—The booth of this concern was handsomely fitted up and on the walls were attractively displayed a complete line of small foundry equipment and supplies, polishing wheels, etc. The elephant, a trade mark of this house, occupied a prominent place in this booth.

STURTEVANT, B. F., CO., Hyde Park, Mass.—The blast for the Baillot cupola was furnished by the new steam turbine blower set made by this concern.

TABOR MFG. CO., Philadelphia.—This concern showed a complete line of molding machines in operation, which included a power squeezing vibrator molding machine, power squeezing, split pattern vibrator machine; hand ramming hinged machine in several sizes, and two new power squeezing hinged molding machines, as well as a power roll-over pattern draft hinged machine. A set of patterns furnished by the Russell & Erwin Mfg. Co., New Britain, Conn., from which souvenirs were cast, were mounted on Tabor machines.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—The booth of this concern was fitted up as a resting place and office, and was tastefully decorated. Samples of foundry lead were shown.

WESTERN FOUNDRY SUPPLY CO., New York and East St. Louis, Mo.—Full line of ferro-alloys and special alloys, such as silicon-copper, etc., for use by iron and brass founders.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—This concern made a joint exhibit with the S. Obermayer Co., Cincinnati, and the Dominion Foundry Supply Co., Montreal. The booth was styled the home of "The Big Three," and contained an overhead trolley system, pneumatic hoist and other equipment made by this concern.

BABBITT METAL DROSS.

Question:—We are experiencing considerable difficulty with our babbitt metal bath on account of the high percentage of dross which gathers on the metal after the bath has been in use for a considerable length of time. Can you tell us how we can prevent this and how we can recover the metal from the dross?

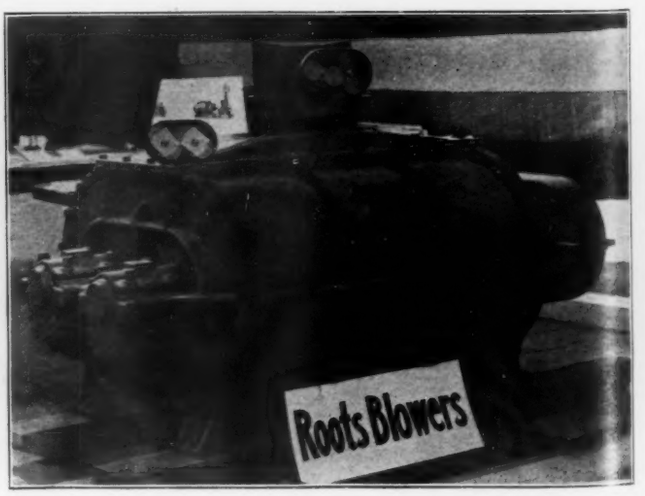
Answer:—Use sal-ammoniac and rosin to flux the metal. When the dross forms, scatter over the bath of the metal some powdered sal-ammoniac and over this a handful of resin. Stir the bath thoroughly with the ladle and the dross will be reduced to dust. This dust you can skim off from time to time, and after it cools, sift it through a No. 16 sieve, which will separate any entrapped metal. This can later be returned to the kettle. The babbitt dust that passes through the sieve should be saved, as it is a salable article. You will find it to your advantage to sell this dust, as it is difficult to reduce.

K. K.

SCREEN PLATES FOR PAPER MILLS.

Question:—I am making plates, 14 inches wide and 40 inches long, with the following mixture: Copper, 83 pounds; tin, eight pounds; lead, 10 pounds; yellow brass, 40 pounds; red brass, 50 pounds; and nickel, three ounces. I have trouble with the castings after they are machined, as they show black spots about the size of a pinhead. All scrap copper and brass are used, with the exception

KROESCHELL-SCHWARTZ GYRATING FLAME FURNACE, KROESCHELL BROS. CO.



P. H. & F. M. ROOTS CO.

FOX MACHINE CO.

HERMAN PNEUMATIC MACHINE CO.

of the tin and the nickel. The plates are used in paper mills.

Answer:—Your difficulty is due to your mixture which contains too much lead. You will have better results by omitting yellow brass. The nickel does not add to the value of this alloy and we presume the object of the red brass is to cheapen the mixture by introducing scrap. A good serviceable alloy for screen plates follows: Copper, 85 pounds, tin, seven pounds, lead, eight pounds; zinc, two pounds. Melt the copper under a cover of charcoal and we are positive that you will have better results. If your brass scrap is carefully selected you can work in possibly 50 pounds with the above mixture. K. K.

THE PRODUCTION OF AUTOMOBILE CYLINDERS*

BY L. N. PERRAULT

THE AUTOMOBILE has undoubtedly done more than anything else to develop the highest degree of skill and accuracy in the foundry. The successful making of the various types of cylinders demands the utmost painstaking, intelligent forethought and supervision. To such an extent is this feature carried out, that some foundries which make a specialty of this class of work, find it profitable and even necessary to employ a skilled man, whose sole duty consists of a constant oversight of each new job, from the arrival of the drawings or patterns; noting the efficiency (or lack of same) with which each operation is conducted and conferring with the superintendent and foreman on points noted, until all are satisfied that no further improvement can be made to hasten production or better the product.

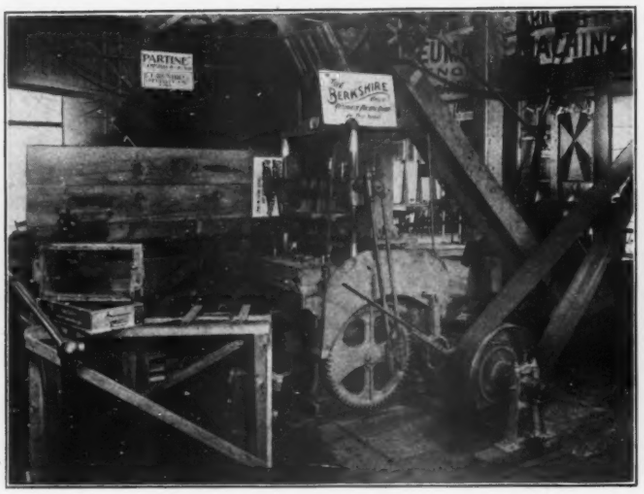
A thorough knowledge of the subject, which can be acquired only by long experience, is indispensable to the foundryman who hopes to make a success of casting water cooled cylinders with the jackets integral. His judgment is also indispensable to the designer, who many times sees only the virtues of his design as compared with others, and either doesn't recognize or ignores the dangers of same from the foundry point of view. Again, unless the man who makes the pattern has a liberal foundry experience and knowledge, his ideas of making the pattern and core boxes so that the molds and cores can be readily assembled would be laughable.

With the most skillfully made pat-

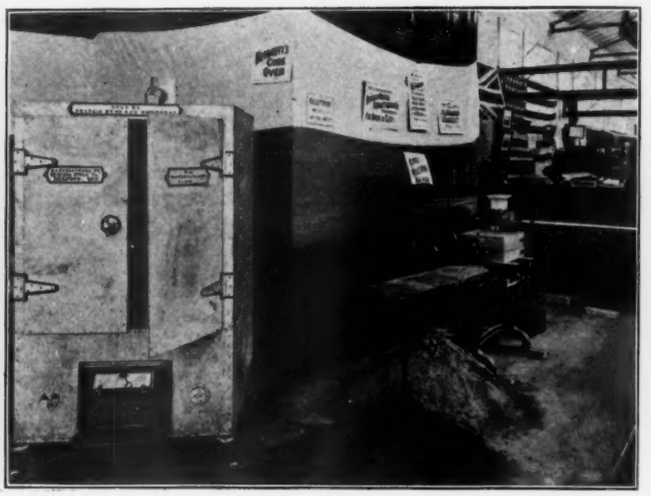
*Presented at the annual meeting of the American Foundrymen's Association.

SAND CUTTING MACHINE, AUTO SAND MIXER CO.

CANADIAN PNEUMATIC TOOL CO.



BERKSHIRE MFG. CO.



FRANCIS HYDE & CO. AND HILL & GRIFFITH CO.

terns and core boxes it is often necessary to make some slight alterations after the cylinder is cast, and it seems almost wonderful that the pattern-maker can work so closely to the many curves and odd shapes as he does and not vary more in the thickness of the metal walls.

The Cores.

Take for illustration, the twin cylinder unit in common use in the two, four and six-cylinder cars both here and abroad. In some patterns, the entire core with the exception of the barrel cores, and consisting of the top and bottom jacket, two ports, one inlet and one exhaust core, are assembled and pasted in a form, which may be made of iron, plaster of paris or oil sand, and which is an exact replica of the bottom of the mold, then dried in the oven and when ready set into the mold as one core. In this case one can readily see the necessity of each core having suitable provision made for locating and locking into exact place, for the variation of even 1/64 inch in one core only would cause the casting to be scrapped. In other patterns of the same outward design, the bottom jacket core is first located in the mold, next the barrel cores, which in this case have port and valve seat cores made integral with them, are set; then the second section of jacket core is pasted in place, and first cheek closed; next the inlet and exhaust cores are set in place and the top jacket pasted on, and then dried in the mold with a gasoline torch and the second cheek and cope closed and clamped ready to cast. Either method is reasonably safe, but of the two, the writer prefers the second, as one has the opportunity of seeing that the cores are properly located after each operation. On this work it is very necessary to have just the right materials for making both the mold and cores.

Skill of the Core Maker.

Consider for a moment the skill and accuracy called for on the part of the core maker, which enables him to make a jacket core as large as a water bucket, varying in thickness from ⅜ inch in some parts to 2½ inches in others, and which must successfully stand a pressure of ⅛ inch of metal outside against ½-inch pressure from the inside. How nicely must the interlacing of wires and wax vents be carried out, first, to support the core against this pressure and in the right location, and, second, to furnish a free and quick egress for the rapidly generated gases.

The Enormous Increase in Demand.

Only a few years ago the American foundryman who could successfully make automobile cylinders was looked upon as a wonder and was much talked of among the fraternity. Even then his best efforts only produced a good one now and then, and his daily production per man is exceeded hourly today, owing to the experience that time has brought about simplifying the design and construction of both patterns and core boxes, as well as educating some of our brightest

CORE OVEN, J. D. SMITH FOUNDRY SUPPLY CO.

R. B. SEIDEL, INC. NORCROSS MOLDING MACHINE CO.

BAIRD & WEST

TABOR MFG. CO.

molders, who have been quick to appreciate the advantages of being specialists in this very interesting line of work. The writer has seen some of the prominent automobile builders increase their output several hundred per cent in the past few years, starting with only one model, and that largely an experiment until now their line includes several types, all of which are standard and wholly successful, and today there are several foundries in America which devote the greater part of their time to supplying this great and growing demand for automobile cylinders.

The great stress laid upon the necessity of saving in weight by the automobile engineer has made thin castings a necessity in cylinders with the water jackets cast integral. Little by little the thickness has been reduced until the danger line was reached, when strengthening ribs were added, these coming as they do in the jacket core boxes, making the problem all the more difficult for the foundryman. Again the presence of bosses for the various studs, etc., often necessitate the use of internal chills to hasten cooling and prevent shrinkage. The enormous strains put upon the cylinders in actual service by reason of vibration, and the unequal heating of different parts by the exploded gases, makes the question of strength an important one. Strong irons are by reason of their chemical composition inclined to be rather hard when cast into such thin sections, yet the engineer demands a strong casting, which must machine uniformly, and be absolutely free from either hard or spongy spots and sound in bosses and jackets.

As the result of careful study and patient experiment, the writer has settled on a mixture, which has stood the test of time and has been uniformly satisfactory, giving a tensile strength of about 36,000 pounds per square inch.

Molding.

When the size of the order will permit, interchangeable iron flasks should be used; these should be as light as is consistent with safety, for in three or four parted work the handling of flasks is quite an item in the molder's labor.

The patterns and core boxes should be of metal, or if wood, the parts most exposed to wear should be protected by metal facing, all loose bosses, etc., so fitted that even the slightest displacement can not occur and such bosses as will permit of it should be cored to avoid shrinkage, for every part of the cylinder must be tight to stand the strains of service. The sand should be of fine texture and open grained, very carefully mixed or ground and worked rather dry, and well blackened with a good grade of plumbago. These points, if carefully observed, should produce smooth round castings in green sand.

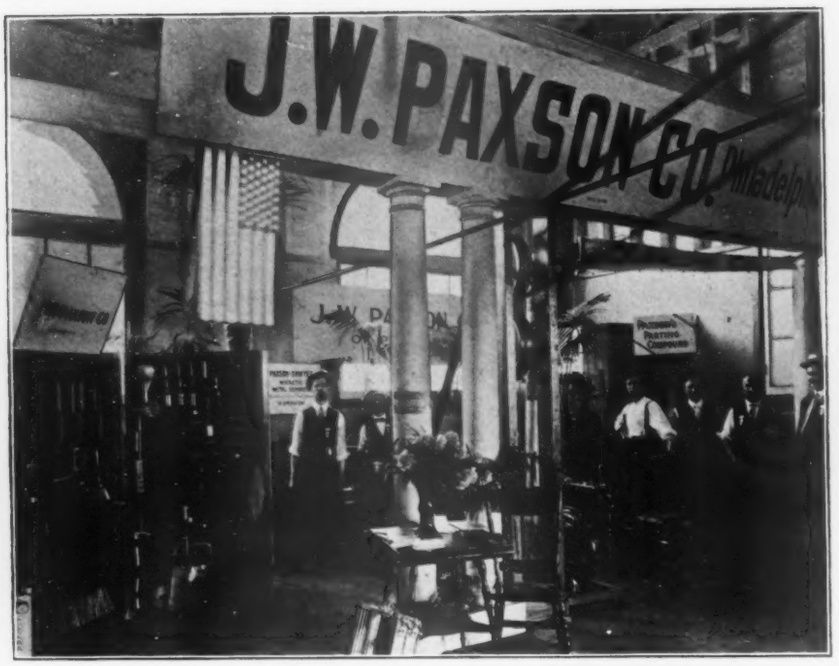
The following methods of molding are used in our foundry, each of which is governed by the type of pattern, size of order, etc.:

First: In this case one molder makes and casts his work.

GREGG MFG. CO.

THE "HAUCK" BURNER
FOR SKIN DRYING MOULDS AND OTHER HEATING PURPOSES.
HAUCK MFG. CO. BROOKLYN, NEW YORK.
CANADIAN REPRESENTATIVE
THE MERRICK FOUNDRY SUPPLY CO. TORONTO.
2 STYLES OF BURNERS
IF INTERESTED

HAUCK MFG. CO.



J. W. Paxson Co.

Second: The different parts of the pattern are fastened to mold boards and skilled molders used on the difficult parts, and cheaper men on the simpler parts, while the coring, closing, etc., are done by another gang and the molds cast by laborers.

Third: The patterns mounted on molding machines operated all day by one gang, while the core setting, casting, etc., are done by others. The writer has in mind a certain cylinder, for several years molded by the first method at a cost per cylinder of 66 2/3 cents each, which was later made on a three-parted molding machine at a cost of 16 cents each, and on which there was a saving in cost in machine shop of 25 per cent over the old method of hand molding.

Core Making.

Iron forms should be made for such cores as need support while drying, others also for shaping the core wires. This can be done by a boy or laborer and stored till wanted. The sand should be strong, sharp and sufficiently fine to give a smooth surface. We prefer an oil binder for various reasons. The wax vents must be of a composition which will neither flatten out nor break under the rammer, and which will melt readily in the oven, and be absorbed by the sand with no detriment to the core. Some wax leaves the core rotten about the vents and is liable to give way to the pressure of the iron while being cast, causing the loss of the cylinder.

The wires should be pliable, yet strong enough to hold their shape when set, and are led to all parts of core in a manner which will permit their ready removal when cast. This is necessary not only for support, but they assist greatly in the removal of the core, which becomes somewhat loosened by their withdrawal and flows through in their wake. After drawing off the box all jacket cores should be carefully examined for exposed wires or vents, and the same remedied before being placed in the oven. After being dried, cores should be well blackened and again dried, and if to be assembled and pasted by the core maker, should be accurately measured by the proper forms and gages and set aside ready for the mold. Our practice is to have the sand and oil carefully measured, mixed and stored in bins and delivered to the benches, the cores placed in the ovens and again delivered to their makers by a gang of laborers, this confining the whole of the core maker's time to the skilled part of the production. The ovens are fired at night only, and the heat regulated by pyrometers which insures a perfect bake.

Each foundry should have its own wax vent machine, with dies for the various sizes needed. One man by two hours' work with the same can turn out vents enough to supply a hundred core makers.

Casting the Cylinders.

The iron should be melted "hot" and handled as quickly as possible to avoid cold shuts in the jackets, also because a casting poured hot is more likely to finish sound than one poured dull. With good sized pouring basins and risers where needed, hot iron of the right mixture, sound cores and a well made mold, the losses on this class of work will be about the usual foundry average.

Cleaning.

We prefer to pickle our castings, first, because there is less risk of breakage than in tumbling, and second, because pickling softens the skin or scale which otherwise is hard on the cutting tools, and lastly, because dirty spots or other blemishes are more apt

Hawley Down Draft Furnace Co.

to be readily found than in a black polished surface.

Our method is as follows: The gates, risers and fins are first removed, next the wires drawn out and the casting lightly tapped with a hammer and rolled from side to side on a plank, bringing each cored hole in turn to the bottom so that the core sand may flow freely out, then at last running a wire from the cored hole to all the remote places and making sure that all the sand is out. The casting then goes to the pickling bench, is well drenched and left till the following morning, when it is washed and goes to the inspector, who carefully looks it over for outward defects, and if none are apparent, measures it with the proper gages and sets it aside to be chipped and filed. The castings are next subjected to hydrostatic pressure of 100 pounds to ascertain if there are any leaks from the water jacket, both externally and internally.

TWO CABINETS OF CORE PRINTS SHOWN BY THE FALLS RIVET & MACHINE CO.

THE AMERICAN MANGANESE BRONZE CO.

The American Manganese Bronze Co., 99 John street, New York City, is a new concern organized for the manufacture of high grade alloys. It has purchased a site of two acres at Holmesburg Junction, within the corporate limits of Philadelphia, where it has erected a model foundry building, equipped with electric traveling cranes, pneumatic devices and other arrangements for economical production, a metal storehouse, coke bins, office building, etc. U. T. Hungerford, president of the company, is a well known figure in the brass and copper industry. C. R. Spare, vice president and general manager of the works, was for a number of years chief engineer of tests of the Wm. Cramp & Sons' Ship & Engine Building Co., where he made a specialty of manganese bronzes. W. A. Locke, secretary and treasurer, was for 20 years connected with the brass and copper business, and W. A. Taylor, superintendent of the foundry, was identified with the production of the first manganese bronze made at the Cramp works 18 years ago. H. A. Wilson is assistant secretary.

Spare's manganese bronze, which the new company is prepared to furnish either in ingots, billets, bars, castings or forgings, is a homogeneous alloy possessing a tensile strength of upwards of 70,000 pounds per square inch, an elastic limit of about 35,000 pounds, elongation of near 25 per cent, and a reduction of area of about the same figure. It can be forged or rolled at a bright cherry heat, is of close, even texture, is highly noncorrosive, does not crystallize when subjected to vibration, and does not segregate in remelting. Its extreme fluidity in a molten state permits of the production of intricate castings true to pattern; these require no annealing and are easily machined. In the company's foundry castings can be made up to 20,000 pounds.

Spare's white bronze, another product, is a bearing bronze combining remarkable anti-frictional properties with a high melting point and an elastic limit in compression of over 5,000 pounds per square inch, rendering it particularly desirable for use where extreme conditions of friction, concussion and pressure are to be met. The company also manufactures Spare's hydraulic bronze castings, United States government compositions, special automobile bearing bronze, and other high grade alloys.

STANDARD SAND & MACHINE CO.

FERRO-ALLOYS IN THE FOUNDRY*

Discussion of the Use of the Various Alloys and the Properties they Impart to Cast Iron

BY W. M. SAUNDERS

THE MANUFACTURER of steel has found the addition of certain metals to endow the steel with properties it did not before possess. The foundry metallurgist, observing this valuable addition to steel, naturally turned to the same metals for improving cast iron.

For many years the high cost prevented a very extensive use of these metals. Within a few years improvements in methods of manufacture, due in part to the progress made in the use of the electrical furnace, or the discovery of new deposits of ore in more accessible localities, have lowered the price. At the present quotations, with few exceptions, the cost prohibits the use of these metals very extensively, except in special cases where castings are required demanding unusual qualities.

Most of the metals employed melt at a higher temperature than cast iron, and consequently do not react to the best advantage with the iron. This difficulty has been overcome by first making an alloy of iron and the metal, which melts at a lower temperature and easily diffuses throughout the cast iron.

The manufacture of ferro-alloys claims an important place in modern industry, and the electrical production has increased until it is one of considerable value.

Manganese.

The importance of manganese to the steel maker cannot be readily estimated. When Bessemer in working out the process for making steel, utilized the discovery of Mushet, that ferro-manganese added at a certain step in the operation produced a sound commercial steel, he not only perfected the manufacture of steel, but placed manganese as one of the most important and necessary metals in that industry.

The ferro-manganese known as spiegeleisen, used at that time, contained from 10 to 15 per cent of manganese, and was made in the blast furnace. Today ferro-manganese can be obtained containing 80 to 85 per cent manganese.

Some years ago, about 1886, R. A. Hadfield discovered that steel with 1½ per cent manganese became brittle. Between 5 and 7 per cent manganese it became very brittle. With the addition of manganese above this amount, the steel began to lose the property of brittleness, and assumed that of toughness and hardness. These qualities greatly increased in the presence of a certain amount of carbon and the proper heat treatment, until the steel contained about 12 per cent manganese, when it became exceedingly tough and hard. This material was known as Hadfield steel.

Effect Upon Cast Iron.

The effect of manganese upon cast iron resembles in many ways that upon steel. High manganese castiugs are employed only in special cases where exceptional hardness is desired. Castings with 1 to 1½ per cent manganese are sometimes made, but the best results are obtained in gray iron with manganese under 1 per cent.

Ferro-manganese in the foundry has an important part to play in perfecting cast iron. It has been claimed that ferro-manganese makes hard iron soft, and soft iron hard. This anomaly is not difficult to explain. Cast iron with a low percentage of manganese often gives trouble in machining, by causing the drills or tools to become dull. This trouble at once disappears upon adding enough ferro-manganese to bring the manganese to 0.5 per cent. High manganese pig iron added to the charge in the cupola will also give the same result.

Manganese reduces the tendency of cast iron to chill, and consequently when ferro-manganese is added in small quantities in the ladle, the iron becomes softened. Advantage is taken of this fact by car wheel makers who add a small amount of ferro-manganese to the molten iron just before casting and thus improve the strength and endurance of the wheel.

Ferro-manganese hardens cast iron by increasing the percentage of manganese. A cast iron may contain the requisite amount of manganese for good machining, but it is necessary to make the iron hard and tough for cylinder purposes. With the addition of enough ferro-manganese to raise the manganese to 1 per cent or over, the desired hardness is produced.

Ferro-manganese removes sulphur from cast iron by forming a compound of sulphur and manganese which rises to the surface as slag, but only when the iron is very hot. It is also beneficial in removing oxides from the iron. The manganese seizing the oxygen combined with the iron, forming manganese oxide which rises to the surface of the molten metal and passes off as slag.

Silicon.

Ferro-silicon containing silicon up to 20 per cent is a product of the blast furnace, and is extensively used in the foundry as a "softener." With the advent of the electrical furnace, ferro-silicon containing as high as 75 per cent silicon became possible. That having 50 per cent silicon is probably the most desirable to use in the iron foundry, on account of its lower melting point. Ferro-silicon is used in steel making as a deoxidizer.

Steel containing a small amount of silicon, was at one time considered undesirable where strength was important. It has now been proven that a small percentage of silicon in a steel greatly increases the elastic limit and tenacity. A further addition causes the steel to become weak, until at about 4 per cent silicon it is very brittle and hard.

Cast iron with 4 per cent silicon also shows weakness, but not as marked as in steel. As the silicon in cast iron increases above 4 per cent the hardness and brittleness become very apparent.

Ferro-silicon melted in a cupola with cast iron in the right amount, tends to soften the iron and reduce strength. A. E. Outerbridge Jr. found the addition of a high grade ferro-silicon (about 50 per cent silicon) to the molten iron in a ladle, not only softened the iron but increased the strength from 15 to 25 per cent, as shown in transverse test bars.

Overheated iron in an air furnace often may be restored to the right condition upon adding a sufficient amount of ferro-silicon, the silicon deoxidizing the iron, leaving it in the proper state for good casting.

Silico-Manganese.

Silico-manganese, containing from 35 to 70 per cent of manganese, and 20 to 25 per cent silicon, the remainder chiefly iron, is sometimes used to raise both the silicon and manganese in cast iron; its action being similar to a mixture of ferro-silicon and ferro-manganese. In steel

*Presented at the annual meeting of the American Foundrymen's Association.

making it is employed as a deoxidizer.

Carbide of silicon, containing about 60 per cent silicon and 30 per cent carbon, is occasionally used in steel making as a deoxidizing agent. In the foundry it is not generally employed on account of its high melting point, but when used is charged in form of lumps with the pig iron in the cupola. The effect of carbide of silicon is to increase the silicon and carbon to some extent.

Aluminum.

Aluminum is used in the manufacture of steel for the purpose of assisting in the formation of sound ingots; little or none of the metal entering into the composition of the product. When an increased amount of aluminum is added, a part alloys with the steel and the effect in small amounts is similar to that of silicon. Either the metal or ferro-aluminum containing 5 to 20 per cent aluminum may be employed.

In cast iron the influence of aluminum resembles in many ways that of silicon. A white cast iron to which ½ to 1 per cent aluminum has been added, assumes at once the appearance of gray iron.

In 1890, W. J. Keep published the results of his experiments upon the addition of aluminum to cast iron. He found the addition of aluminum increased the proportion of graphitic carbon, and the softening of the iron increased up to 4 per cent. Aluminum added in large amounts reduces the total carbon by throwing out the graphite. Aluminum diminishes the tendency of cast iron to chill; it also reduces shrinkage and increases strength when in small amounts. Above 4 per cent aluminum the softening influence begins to diminish, and the strength of the iron to become less, until cast iron with 12 to 14 per cent aluminum is very weak.

Phosphorus.

Ferro-phosphorus is made containing from 20 to 25 per cent phosphorus. In steel making it is used to increase the phosphorus in basic slag for certain purposes, and also to add phosphorus to steel used in making thin rolled plates.

In the foundry ferro-phosphorus is employed to increase the phosphorus in cast iron in the ladle, when it is desired to prolong the time of fluidity, as in the case of very thin castings.

Cast iron containing about 1½ per cent phosphorus causes the tools used in machining it to become heated and quickly worn, while with 2 per cent and over, cast iron becomes brittle and weak.

Phosphorus under 1 per cent in general machinery castings is desirable, and in some cases as low as 0.2 per cent is necessary to secure strong iron.

Titanium.

Ferro-titanium is made containing 10 to 30 per cent titanium. In the form of ferro-alloy, and also as titanium-thermit, titanium is used in small amounts in steel making and in the iron foundry to remove gases absorbed by the molten metal. The action is purely chemical, the titanium combining with oxygen forming oxides, and with nitrogen forming nitrides of titanium, the resulting compounds being found in the slag; none of the titanium entering into the iron, which remains soft. With larger additions of the alloy, a small percentage of titanium unites with the iron tending to harden it.

Whether the action of titanium is direct by alloying with the iron, or indirect by the removal of gases, the results show marked improvement in the iron. Test bars made from cast iron to which 1 to 5 per cent of ferro-titanium (containing 10 to 12 per cent titanium) had been added, showed an increased transverse strength up to 40 per cent over bars made from iron receiving no titanium.

Vanadium.

Ferro-vanadium can be obtained containing from 10 to 50 per cent vanadium. Small amounts of vanadium added to steel, not only increases the tensile strength without making the steel hard, but prolongs its ability to withstand shocks and fatigue. One action of vanadium is probably similar to silicon and aluminum, removing the oxygen and oxides, thus leaving the steel in a purified condition. A small amount of vanadium will be found in the steel, and it very likely has an influence upon the carbon present, which in turn imparts its properties.

Dr. Richard Moldenke lately made an important investigation upon the effect of vanadium on cast iron. The result of the experiments showed an increase in transverse strength on test bars of gray iron from 2,000 to 2,500 pounds, and white iron from 1,500 to 3,900 pounds. These results were obtained by adding a few tenths per cent of vanadium in the form of ferro-vanadium; and also indicated that beneficial action could be obtained by so treating molten iron used to make chilled rolls and car wheels.

Nickel.

The introduction of 3 to 3½ per cent nickel in steel causes an increase of about 30 per cent in tensile strength, and fully 75 per cent in the elastic limit, without apparently changing the elongation. Further addition effects the hardness until with 16 to 18 per cent nickel the steel becomes exceedingly hard and difficult to machine. Upon increasing the nickel contents above this point the material becomes soft. The hardening action of nickel upon steel is probably due to its effect upon the carbon.

The action of nickel upon cast iron has been investigated by J. F. Webb. It was found the addition of between ½ and 7 per cent nickel "showed no marked improvement in the physical strength of the casting."

Cast iron with 30 per cent nickel is not easily corroded by water or exposure to the usual atmospheric conditions.

Chromium, Tungsten and Molybdenum.

These metals alone or in form of ferro-alloys, have but little influence upon cast iron. In steel, however, they have an important place to fill. Chromium is used in projectiles and tool steel for its hardening properties. Tungsten and molybdenum are employed chiefly in the manufacture of tool or self-hardening steel.

Conclusion.

It is hoped what has been stated in favor of certain alloys will not cause them to be taken as a panacea for all foundry troubles. When employed in an intelligent manner, that is, with a knowledge of the chemical composition of iron and alloy used, there is no doubt that ferro-alloys will greatly assist the foundryman in the many and not too easy metallurgical problems with which he has to deal.

ANTIMONY.

Antimony is a white metal which fuses at a low temperature and is readily vaporized. It is of a laminated or crystalline texture and is very brittle. It is used in several valuable alloys, but is not used in the pure state; its most important alloys are type metal, britannia metal, pewter and various antifriction metals. Type metal consists essentially of lead and antimony, with, frequently, the addition of tin, nickel or copper in small quantities. Britannia is a white-metal alloy much used for tableware, and consists of antimony, with tin, copper and bismuth. A similar alloy, containing, however, a smaller percentage of antimony, is pewter. The anti-friction alloys usually are known as babbitt metals. One of them consists of 30 parts of tin to 5 antimony and 1 of bismuth, but, as is well known, various proportions are employed. Antimony has a hardening effect when added to lead; a small quantity of bismuth gives the alloy the property of expanding at the instant at which it solidifies, the result being a perfect cast from the mold.—*Canadian Engineer.*

This is one of the latest alloys to be introduced to the foundry trade, and being a powerful deoxidizing agent it combines with both oxygen and nitrogen and aids in removing these gases from iron. It has a tendency to increase the chill and transverse strength of cast iron.

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The Toronto Convention

The record breaking attendance at the Toronto convention of the American Foundrymen's Association, as well as the profound interest manifested in the proceedings, reflected the rapid forward strides that are being made in all branches of the foundry industry. The exhibits of molding machines and equipment, more numerous and extensive than at any previous meeting, convincingly showed the advancement that has been recorded in labor-saving devices during the last 12 months, while the discussions of metallurgical and chemical problems indicated a greater interest in the science of foundry work than has heretofore been displayed. Without reflecting upon the labors and achievements of foundry investigators. President Stanley G. Flagg Jr., in his opening address emphasized the need of further research work along lines not heretofore touched upon. To defray the expenses of these tests and experiments a fund is being raised by the association, and while the total amount required has not been subscribed, it is certain that the question of finances will not embarrass this work in the future.

Although only tentatively proposed, the plan outlined to insure a greater unity of action among the various foundrymen's organizations is worthy of adoption. None of the societies will lose their identity, and considerable work now duplicated could be eliminated and the expense of conducting the affairs of each organization would be greatly reduced by the establishment of a central bureau. The executive committee of the Associated Foundry Foremen has been instructed to act in harmony with such a plan, should it be projected during the year, and the other societies will undoubtedly give it their serious consideration.

The facilities provided for the meeting by the Toronto municipal authorities could not have been surpassed and all of the visitors enjoyed the proverbial hospitality for which Canada is renowned. The entertainment features, though lavish, were well arranged and did not interfere with any of the business sessions.

That foundrymen in general are showing a greater appreciation of the educational value of these conventions was indicated by the large attendance of shop superintendents and foremen, no less than 14 men being present from one plant, and others were represented by two, three and four heads of departments, respectively. The stove founders likewise sent a committee to investigate the molding machine problem and to look into the merits of the machines adapted to the molding of stove plate. In no branch of the foundry industry have the operators shown a greater aversion to the introduction of this labor-saving equipment than in the stove trade, yet such satisfactory results have been reported from plants in which machines are now being operated that it is certain they will come into general use in the near future.

The operating exhibits in Machinery hall again proved an attractive feature, heats being made daily, the metal being furnished by a cupola and a battery of oil melting furnaces. Every foundry operation was provided for, from the making of the molds and the baking of the cores to the cleaning of the castings. That the jobbing foundry molding machine problem has been solved was indicated by the large number of machines displayed adapted for jobbing foundry use, and that the proper preparation of sand is receiving consideration by American foundrymen was reflected by the large number of machines shown fitted for this work.

Trade Outlook

The reduction of 50 cents a ton in the price of Lake Superior ores has led consumers to conclude that still lower quotations on pig iron will prevail, although furnace operators claim that the reduction has been more than discounted on some of the sales made within the past few months. Recent concessions on raw materials, as well as finished products, it is believed will lead to resumption of buying, although no material improvement is anticipated immediately. In the south, No. 2 foundry iron is selling at $12, Birmingham, and this price is being firmly maintained by all of the producers. Some heavy sales have recently been made on this basis, a large implement maker in the west having covered his requirements for the next three months. Lake Superior charcoal iron is held at $20, Chicago, and northern No. 2 at $17.50. In the Pittsburg district No. 2 foundry is selling at $15, and malleable Bessemer at an advance of 25 to 50 cents a ton. Jobbing founders with few exceptions report a slight improvement, but the increase in orders is not sufficient to insure the operation of their plants at full capacity. The dearth of railroad tonnage is responsible for the inactivity of the malleable and steel foundries, while the

tonnage of other specialty shops continues limited. The fact that the pattern shops are busier than at any time this year is believed to be the forerunner of improved conditions in the foundry trade.

At the foundrymen's convention held in Toronto, the supply and equipment manufacturers booked many orders, and they were unanimous of the opinion that prospects are brighter than they have been at any time since the depression set in. Makers of plumbers' supplies have been affected by the curtailment of building operations, although the shops melting brass and aluminum for the automobile trade report the demand fairly well sustained.

PERSONAL.

S. P. Fillman, superintendent of the Alaska Graphite Co., Oakland, Cal., sailed from San Francisco, May 28, to again take charge of the company's graphite properties. The small shipment delivered last season found such a ready sale that it is the intention of this concern to make heavier shipments this season to supply the entire Pacific coast trade.

Prof. Arthur Lucian Walker has been appointed professor of metallurgy and administrative head of the department of metallurgy at Columbia university, New York. His duties begin on July 1 and he will take personal charge of the instruction in non-ferrous and electro-metallurgical design. Prof. Howe will continue to deliver his lectures on iron and steel as heretofore.

L. P. Mercer has been appointed resident manager of the Chicago office of the De Camp Bros. & Yule Iron, Coal & Coke Co., St. Louis.

J. R. McColl, formerly associate professor of steam engineering at Purdue university, and now connected with the engineering department of the American Blower Co., Detroit, has been delivering a series of lectures before the engineering classes of the technical schools in the middle west. The subjects of air for heating, ventilating and drying systems and theory and practice of blower design and installation and kindred topics.

A COMPOUND PRESSURE BLOWER.

The fact that the pressure at which air is delivered by a centrifugal fan is determined by the peripheral speed of the blast wheel, has prevented manufacturers of these fans from connecting these larger sizes direct to electric motors, since the speed of the larger motor is limited. In the past it has been necessary to use belted outfits where a pressure of over 6 or 8 ounces was required. The belted machines require more floor space, more attention to bearings, and are also less efficient than the direct connected outfits.

The Buffalo Forge Co., Buffalo, has designed a compound blower which will deliver the air at double the pressure of the simple fan with the same diameter blast wheel, when run at the same speed. This permits blowers of practical and efficient proportions for direct connection to large motors, of 50 and 75 horsepower. The blast wheels are mounted on a single shaft and incased in a cast iron housing, built up in transverse sections, permitting the interior parts to be easily inspected or removed. The wheels are of a special design, the arms being secured to the hub tangentially, instead of radially, the usual practice. This eliminates the necessity of bending the T irons through a large angle, which in addition to weakening the wheel, offers more resistance to the flow of air.

A single inlet is provided on the side opposite the motor. Being unobstructed, a smaller inlet for air is permissible. The advantage of this is apparent. The air entering the fan does not strike that portion of the blade which is moving at a high velocity until the direction of the air has changed and the air itself has attained a high velocity. The curvature of the blade is such that the velocity of the air is gradually increased as it approaches the tip, at which point the velocity of the air is slightly above that of the blade. The air from the first stage is discharged into a pressure chamber about the entire circumference of the wheel, the pressure in this chamber being approximately one-half the total pressure at which the air is delivered. Here the air enters the second stage, the blast wheel of which is the same as in the first. The scroll in this stage is involute in form and so designed as to increase the area in the casing directly as the increase in volume of air discharged from the blast wheel throughout a single revolution. Substantial

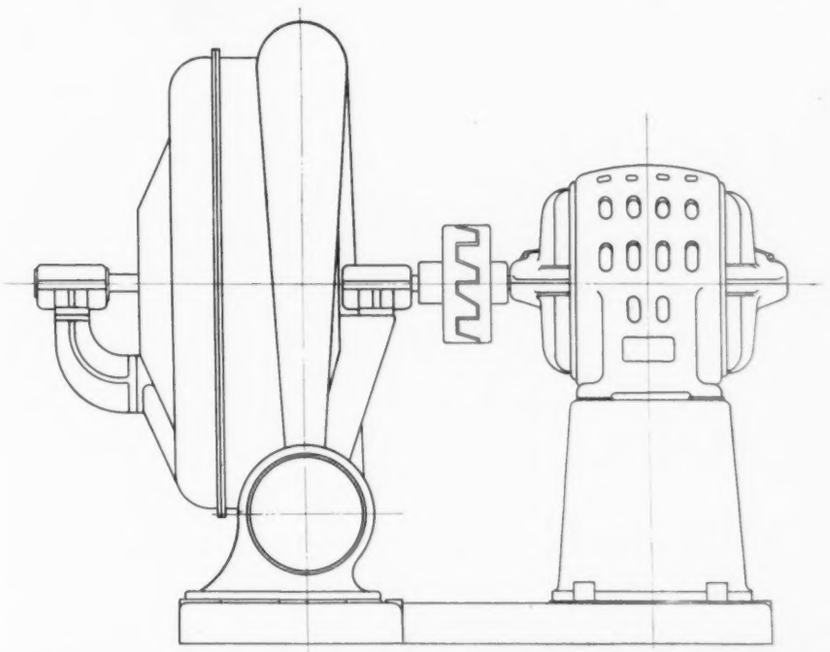


FIG. 1—BUFFALO COMPOUND PRESSURE BLOWER

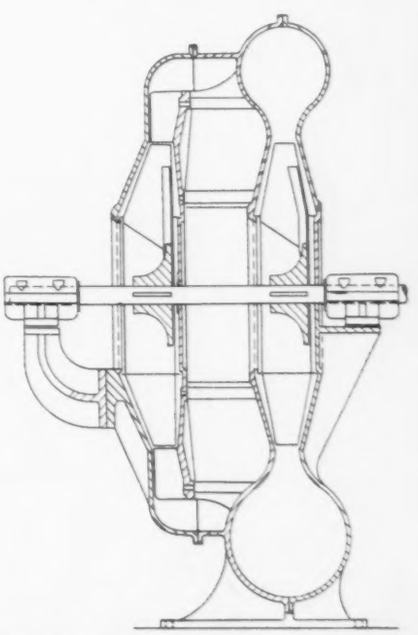


FIG. 2—INTERNAL CONSTRUCTION OF BUFFALO COMPOUND PRESSURE BLOWER

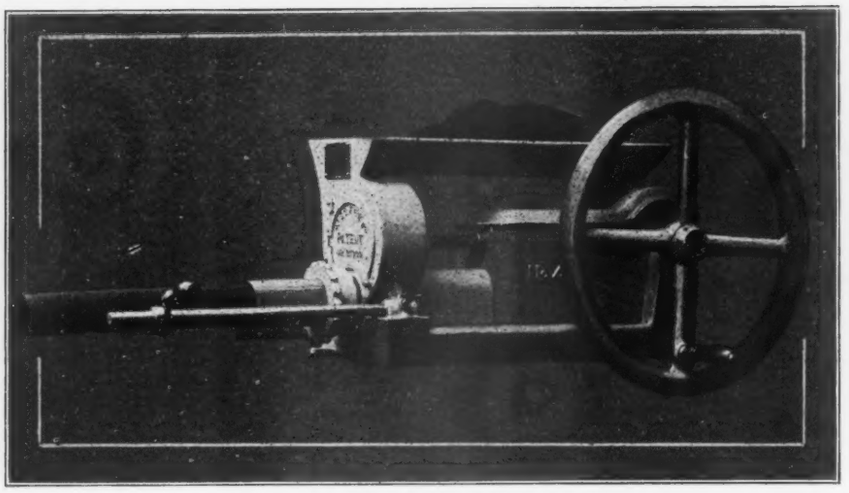


FIG. 1—PLUNGER TYPE CORE MACHINE

oil ring bearings are provided, one on each side of the housing as shown in the drawings, and when the width of the blower is sufficient to require such, another bearing is located in the pressure chamber between the two stages.

A number of these fans of the larger sizes have been installed by the Lehigh Valley railroad, Fanner Mfg. Co., Strong, Carlisle & Hammond Co., and the Indiana Steel Co., of Gary, Ind.

Two of these fans are now being constructed for the latter to supply blast to cupolas at a pressure of 16 ounces per square inch. Each fan will deliver a maximum of 9,500 cubic feet of air per minute at a speed of 1,420 revolutions per minute. They will be driven by a 75-horsepower General Electric 3-phase, 440-volt, 25-cycle induction motor.

These blowers of the above capacity with the motor mounted on a cast bedplate occupy a floor space of only 7 by 5 feet and the height is about 7 feet which would be the same as a simple blower of this capacity delivering the air at one-half the pressure. The blowers are equipped with a flexible coupling designed by the Buffalo Forge Co., which, in addition to being flexible, acts as an insulator between the motor and the blower. There is no metal contact, the torque being transmitted through solid rubber cylinders bedded in machined grooves in each half of the coupling.

These blowers are made in all sizes up to capacities of 12,000 cubic feet of air per minute, at any pressure up to 24 ounces per square inch.

OBERMAYER BULLETIN.

The June number of the *Obermayer Bulletin*, published by the S. Obermayer Co., Cincinnati, contains an interesting article on "Some Stove Foundry Equipment," by R. H. McDowell. C. Metcalf contributes an article on pipe making and Samuel H. Fisher describes an excellent device by which the necessity of mudding up oven doors is obviated.

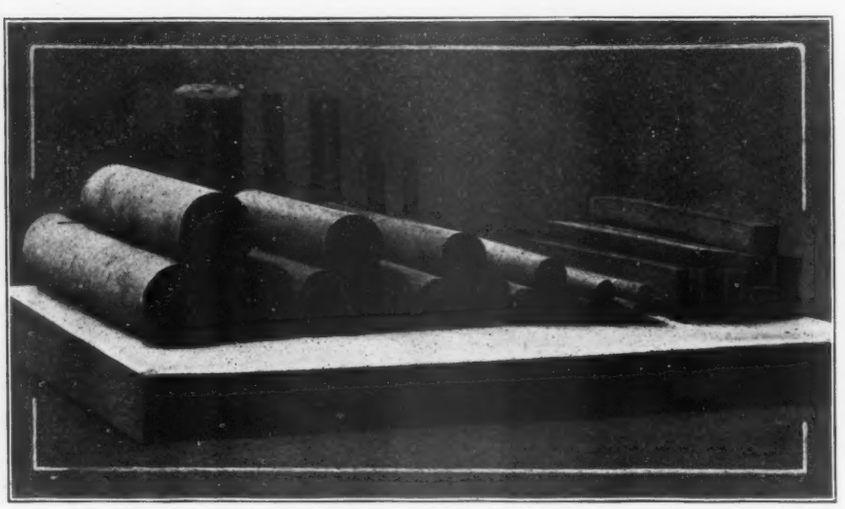


FIG. 2—CORES MADE ON PLUNGER CORE MACHINE

PLUNGER CORE MACHINE.

A core machine of the plunger type is now being offered to the American foundry trade by Actiebolaget Malcus Holmquist, Halmstad, Sweden. The machine shown in Fig. 1 is so constructed that the porosity of the cores can be regulated and it is claimed that neither core oil nor compounds are required to make satisfactory cores. The sand is forced into the tube by means of a walking plunger which packs it around a vent needle that forms the vent in the core. This needle passes through the plunger but is not affected by the movement of the latter and extends throughout the entire machine. To insure the packing of the sand from the repeated strokes of the plunger the latter is provided with pins or hooks on its face, which tear down the end of the core next to the plunger and prevent the making of a joint in the core when the next charge of sand is forced through the tube. The feeding hopper is provided with a rotating arm which agitates the sand and prevents caking. The front end of the core needle which extends ½ inch inside of the tube is flared at the end, and by its adjustment the porosity of the cores can be regulated. By extending the flared point further into the tube the core becomes closer, and by setting the point back into the tube the cores can be made more porous.

Cores of sections can be made on this machine as shown in Fig. 2, including round, square, octagonal, slab, etc., core tubes for which are furnished. The plungers for the cores of various sizes are slightly smaller than the core tubes. In most instances the sand used for making cores on this machine is only moistened with molasses water and it is claimed that excellent results have been obtained with a poor grade of sand without the use of a binder.

TRADE NOTES.

The Kerr Turbine Co., Wellsville, N. Y., is executing many orders, notwithstanding unfavorable business conditions. Contracts recently closed include the following: Two 60-horsepower Kerr steam turbines coupled to a No. 8 Sturtevant gas blower for the Economical Gas Apparatus Construction Co., Aberdeen, Scotland; 10 single-stage Kerr steam turbines with disk fans for the Lathrop Engineering Co., New York; one 10-kilowatt turbine generator set for the Agricultural & Mechanical College of Mississippi; one four-horsepower, single-stage turbine for driv-

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication.

STANDARD SPECIFICATIONS FOR CAST IRON PIPE AND SPECIAL CASTINGS.*

(Continued from Data Sheet No. 20.)

TABLE No. 2.—STANDARD THICKNESSES AND WEIGHTS OF CAST IRON PIPE.

Nominal Inside Diam., Inches.	Class A. 100 Ft. Head. 43 Lbs. Pressure.			Class B. 200 Ft. Head. 86 Lbs. Pressure.			Class C. 300 Ft. Head. 130 Lbs. Pressure.			Class D. 400 Ft. Head. 173 Lbs. Pressure.			Nominal Inside Diam. Inches.
	Thickness. Inches.	Weight per		Thickness. Inches.	Weight per		Thickness. Inches.	Weight per		Thickness. Inches.	Weight per		
		Foot.	Length.		Foot.	Length.		Foot.	Length.		Foot.	Length.	
4	0.42	20.0	240	0.45	21.7	260	0.48	23.3	280	0.52	25.0	300	4
6	0.44	30.8	370	0.48	33.3	400	0.51	35.8	430	0.55	38.3	460	6
8	0.46	42.9	515	0.51	47.5	570	0.56	52.1	625	0.60	55.8	670	8
10	0.50	57.1	685	0.57	63.8	765	0.62	70.8	850	0.68	76.7	920	10
12	0.54	72.5	870	0.62	82.1	985	0.68	91.7	1,100	0.75	100.0	1,200	12
14	0.57	89.6	1,075	0.66	102.5	1,230	0.74	116.7	1,400	0.82	129.2	1,550	14
16	0.60	108.3	1,300	0.70	125.0	1,500	0.80	143.8	1,725	0.89	158.3	1,900	16
18	0.64	129.2	1,550	0.75	150.0	1,800	0.87	175.0	2,100	0.96	191.7	2,300	18
20	0.67	150.0	1,800	0.80	175.0	2,100	0.92	208.3	2,500	1.03	229.2	2,750	20
24	0.76	204.2	2,450	0.89	233.3	2,800	1.04	279.2	3,350	1.16	306.7	3,680	24
30	0.88	291.7	3,500	1.03	333.3	4,000	1.20	400.0	4,800	1.37	450.0	5,400	30
36	0.99	391.7	4,700	1.15	454.2	5,450	1.36	545.8	6,550	1.58	625.0	7,500	36
42	1.10	512.5	6,150	1.28	591.7	7,100	1.54	716.7	8,600	1.78	825.0	9,900	42
48	1.26	666.7	8,000	1.42	750.0	9,000	1.71	908.3	10,900	1.96	1,050.0	12,600	48
54	1.35	800.0	9,600	1.55	933.3	11,200	1.90	1,141.7	13,700	2.23	1,341.7	16,100	54
60	1.39	916.7	11,000	1.67	1,104.2	13,250	2.00	1,341.7	16,100	2.38	1,583.3	19,000	60

The above weights are for 12 feet laying lengths and standard sockets; proportionate allowance to be made for any variation therefrom.

*Adopted by the American Society for Testing Materials.

Allowable Variation in Thickness.

For pipes whose standard thickness is less than 1 inch the thickness of metal in the body of the pipe shall not be more than 0.08 of an inch less than the standard thickness, and for pipes whose standard thickness is 1 inch or more, the variation shall not exceed 0.10 of an inch, except that for spaces not exceeding 8 inches in length in any direction, variations from the standard thickness of 0.02 of an inch in excess of the allowance above given shall be permitted.

For special castings of standard patterns a variation of 50 per cent greater than allowed for straight pipe shall be permitted.

Defective Spigots May be Cut.

Defective spigot ends on pipes 12 inches or more in diameter may be cut off in a lathe and a half-round wrought-iron band shrunk into a groove cut in the end of the pipe. Not more than 12 per cent of the total number of accepted pipes of each size shall be cut and banded, and no pipe shall be banded which is less than 11 feet in length, exclusive of the socket.

In case the length of a pipe differs from 12 feet, the standard weight of the pipe given in table No. 2 shall be modified in accordance therewith.

Special Castings.

All special castings shall be made in accordance with the cuts and the dimensions given in the table forming a part of these specifications.

The diameters of the sockets and the external diameters of the bead ends of the special castings shall not vary from the standard

(Continued on Data Sheet No. 22.)

(Continued from Data Sheet No. 21.)

dimensions by more than 0.12 of an inch for castings 16 inches or less in diameter; 0.15 of an inch for 18-inch, 20-inch and 24-inch; 0.20 of an inch for 30-inch, 36-inch and 42-inch, and 0.24 of an inch for 48-inch, 54-inch and 60-inch. These variations apply only to special castings made from standard patterns.

The flanges on all manhole castings and manhole covers shall be faced true and smooth, and drilled to receive bolts of the sizes given in the tables. The manufacturer shall furnish and deliver all bolts for bolting on the manhole covers, the bolts to be of the sizes shown on plans and made of the best quality of mild steel, with hexagonal heads and nuts and sound, well-fitting threads.

Marking.

Every pipe and special casting shall have distinctly cast upon it the initials of the maker's name. When cast especially to order, each pipe and special casting larger than 4-inch may also have cast upon it figures showing the year in which it was cast and a number signifying the order in point of time in which it was cast, the figures denoting the year being above and the number below, thus:

1901	1901	1901
1	2	3

etc., also any initials, not exceeding four, which may be required by the purchaser. The letters and figures shall be cast on the outside and shall be not less than 2 inches in length and ⅛ of an inch in relief for pipes 8 inches in diameter and larger. For smaller sizes of pipes the letters may be 1 inch in length. The weight and the class letter shall be conspicuously painted in white on the inside of each pipe and special casting after the coating has become hard.

Allowable Percentage of Variation in Weight.

No pipe shall be accepted the weight of which shall be less than the standard weight by more than 5 per cent for pipes 16 inches or less in diameter, and 4 per cent for pipes more than 16 inches in diameter, and no excess above the standard weight of more than the given percentages for the several sizes shall be paid for. The total weight to be paid for shall not exceed for each size and class of pipe received the sum of the standard weights of the same number of pieces of the given size and class by more than 2 per cent.

No special casting shall be accepted the weight of which shall be less than the standard weight by more than 10 per cent for pipes 12 inches or less in diameter, and 8 per cent for larger sizes, except that curves, Y pieces and breeches pipe may be 12 per cent below the standard weight, and no excess above the standard weight of more than the above percentages for the several sizes will be paid for. These variations apply only to castings made from the standard patterns.

Quality of Iron.

All pipes and special castings shall be made of cast iron of good quality, and of such character as shall make the metal of the castings strong, tough and of even grain, and soft enough to satisfactorily admit of drilling and cutting. The metal shall be made without any admixture of cinder iron or other inferior metal, and shall be remelted in a cupola or air furnace.

(Continued on Data Sheet No. 23.)

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

ing a Buffalo Forge Co. blower for service in Mexico; one 15-kilowatt, direct-connected Kerr-Sterling generator set for C. Deuterman & Sons, White Plains, N. Y.; one 150-kilowatt Kerr-Westinghouse, direct-connected unit for Janeway & Carpenter, New Brunswick, N. J.; one 100-kilowatt Kerr-Burke turbine alternator for the Warren Mfg. Co., Milford, N. J.; one 85-horsepower Kerr steam turbine for the Sirocco Engineering Co., New York; four 200-horsepower Kerr steam turbines to drive centrifugal pumps for the Wheeler Condenser & Engineering Co., New York; one 1,200-gallon Worthington pump unit, for the Mississippi commission, Vicksburg; one 60-horsepower turbine to drive a centrifugal pump, for the Dayton Hydraulic Machinery Co., Dayton, O.

The Northern Engineering Works, Detroit, has recently received the following orders: Three-motor electric cranes of 7½ tons capacity from the Cummings Foundry, Chicago, and the United Lead Co.; a five-ton, 35-foot span crane for the West India Electric Co., and a six-ton, two-motor electric crane for the Valentine Bohl Co., Waterbury, Conn.

The New York office of the Hawley Down Draft Furnace Co. has been removed to Room 1738, 42 Broadway.

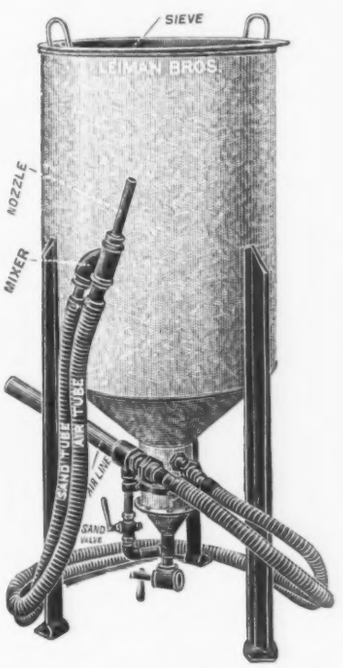
The business of the Cleveland Castings Pattern Co. shows a nice increase during the past six months over the same period last year. During the past week this concern secured orders from two big concerns for making patterns for several sizes of large engine frames, in addition to many smaller orders. A large force of men is working full time in all departments.

The new plant of the Jonathan Bartley Crucible Co., Trenton, N. J., is rapidly nearing completion. It is probable that the manufacture of crucibles will be commenced in August.

The Doggett Mfg. Co., 101-105 Beekman street, New York, has been organized for the manufacture of "Fill-it" iron cements and compounds. These cements can be used for repairing and filling impressions in iron and steel castings, for repairing leaks, cracks or defects in castings, boiler tanks, etc., and for making joint connections in iron pipe and fittings. Other products made by this concern include rivet iron cement packing and gasket cement; cement for iron coating and filling; tin and roof cement; asbestos and stone cements.

The firm of Francis Hyde & Co., 31 Wellington street, Montreal, Quebec, has made a specialty of the sale of fire brick and cupola blocks to the founders of Canada for the past 25 years. On Jan. 1 it was decided to handle a general line of foundry supplies and equipment and they are now representing the following concerns: Harbison-Walker Refractories Co., Pittsburg, fire brick and clay; Hill & Griffith Co., Cincinnati, foundry facings; Western Foundry Supply Co., New York, ferro-alloys; Bridgeport Crucible Co., Bridgeport, Conn., crucibles; Robeson Process Co., Au Sable Forks, N. Y., "Glutrin;" Stanley Doggett, New York, Perfection parting compound. In addition to these the King molding machine is sold, as well as the Blodgett core oven. This concern is the pioneer manufacturer of core ovens and molding machines in Canada and will soon manufacture a full line of foundry equipment.

The Rockwell Furnace Co., 26 Cortlandt street, New York City, has been organized to carry on an engineering business and to manufacture metallurgical furnaces and fuel oil and gas burning appliances. The officers are: F. S. Garrett, president, and W. S. Quigley, vice president and general manager. Both officers and employes of the newly organized company have been connected for a number of years with the Rockwell Engineering Co. and are thoroughly well experienced in these lines. A specialty will be made of oil, coal and gas furnaces for every variety of use and of oil and gas burning appliances, although blowers, both fan and positive, separators, storage tanks, valves and extensive line of similar products will be manufactured. The company is in a position to furnish complete furnace equipments of high standard.



LEIMAN SAND BLAST MACHINE

The Western Foundry Supply Co., 30 Church street, New York City, announces that it has awarded its selling agency to Rogers, Brown & Co. It has plants at East St. Louis and at Elizabethport, N. J., with offices at the former location and in New York. Its lines include both ground and lump ferro-manganese, and ferro-silicon, ferro-chrome, manganese-copper and other alloys. The company has come to the front rapidly and with its improved selling facilities expects to enlarge its operations accordingly.

SAND BLAST FOR FOUNDRY WORK.

In the sand blast machine, shown in the accompanying illustration, a system of piping is employed by which the air does not pass through the body of the machine but passes directly to the mixing chamber at the base of the nozzle where a vacuum is created which draws the sand from the machine to the sand pipe. When the sand reaches the nozzle it receives the full force of the air pressure. As a result of this arrangement it is not necessary to build the sand hopper of heavy steel plates, and the cost of construction is greatly reduced. The machine is about five feet high and is constructed of galvanized iron supported on three iron legs. Enough sand may be placed in the machine for continuous operation for a period of three or four hours. The sand, after having been thoroughly dried, is thrown into a depressed sieve at the top of the hopper where it is automatically sifted. By the system of piping employed, whereby the sand receives the full impact of the air at the nozzle, a much broader and longer nozzle may be used than is ordinarily employed. The nozzle consists of an iron pipe not tapered, and is furnished several feet in length if desired. Having straight walls the nozzle is not subjected to great wear. The machine is furnished complete with a 10-foot double length of wire covered hose, hose coupling and nozzle. For light work requiring a pressure of from four to six pounds, a positive pressure blower especially designed for this work can be furnished. For larger work air compressors are used. The machine is built by Leiman Bros., 139 to 143 Centre street, New York.

TRADE PUBLICATIONS.

PNEUMATIC TOOLS.—The Cleveland Pneumatic Tool Co., Cleveland, has issued a handsomely illustrated 36-page catalog, describing its complete line of riveting, chipping, beading, calking, and scaling hammers, reversible and non-reversible drills, emery grinders, and other pneumatic tools.

STOVE PLATE MOLDING MACHINES.—The molding of stove plate on machines is described in a 30-page catalog issued by Henry E. Pridmore, Chicago. Illustrations are shown of the Pridmore plain rock-over machine fitted with a heater top and range grate rest patterns, as well as with foot rail, ash pit

doors, stove doors and other stove patterns. According to this catalog there are in the United States and Canada approximately 300 manufacturers of stoves, and careful investigation has revealed the fact that of this number not more than 30 have equipped their shops with molding machines. The results that are being obtained in the few plants in which the machines have been installed show a tremendous saving in labor costs and it is believed that the awakening of the stove trade to the value of the molding machine is at hand.

ALLAN METAL.—A. Allan & Son, New York, have published a 16-page catalog descriptive of this anti-friction metal, together with suggestions for its practical application.

FIRE BRICK.—Bulletin No. 1, issued by Francis Hyde & Co., Montreal, Canada, contains a list of fire brick of all sizes sold by this concern, as well as magnesia, chrome, silica, and other refractory brick. In addition, this concern handles foundry facings, iron and brass foundry supplies, and a general line of foundry equipment.

DYNAMO BRUSHES.—The Cutler-Hammer Mfg. Co., Milwaukee, has issued a 16-page pamphlet describing its Wirt type dynamo brushes for use with low tension direct current motors and generators, alternating current generators, plating dynamos, exciters, etc.

GENERAL INDUSTRIAL NOTES

The Oxy-Carbi Co., 17 Webster street, New Haven, Conn., has begun the manufacture of oxy-acetylene welding and cutting plants. This concern will also do a general business in the brazing of cast iron, semi-steel, soft steel, copper and brass.

Rapid progress is being made in the construction of a new plant of the Tropenas Steel Co., at New Castle, Del. This concern is capitalized at $750,000 and will engage in the manufacture of steel castings by the side blow process. Alexander Tropenas, of Paris, France, is president; Arthur Simonson, Philadelphia, vice president; and D. J. Reinhardt, Wilmington, Del., is secretary. The active management of the company will be under the control of Mr. Simonson, who was formerly connected with Wm. Wharton Jr. & Co., Inc., Philadelphia.

The Luzerne Mfg. Co. and the Frantz Engine Co. have consolidated their plants under the firm name of Luzerne Foundry & Machine Co., Luzerne, Pa. The Frantz company's plant, located at Cherryville, Pa., will be dismantled and the machinery moved to Luzerne.

The Houldsworth Foundry Co., Brooklyn, has been incorporated with a capital of $10,000 and will conduct a gray iron foundry. Wm. O. Fitch, 278 Monroe street, Brooklyn, is one of the incorporators.

At a meeting of the stockholders and directors of the E. H. Bardes Range & Foundry Co., Cincinnati, officers were elected as follows: E. H. Bardes, president; Chas. H. Resor, first vice president; L. E. Denning, second vice president; Wm. Krummel, treasurer, and F. S. Krug, secretary. The new company has remodeled the three-story plant formerly occupied by the Wm. Resor Co., at 2619 Colerain avenue, and will manufacture stoves of both the Resor and Bardes types. The company is now planning a number of improvements. The capital stock is $60,000.

The Southern Wisconsin Foundry Co., Madison, Wis., has been incorporated with a capital of $25,000. Henry A. Kanbe, Herman M. Vance and Samuel G. Scanlon are the incorporators.

The Angola Engine & Foundry Co., Angola, Ind., is contemplating the removal of its plant from that city to some point affording better shipping facilities. To this end the company is engaged in correspondence with representatives of commercial bodies in different cities, but as yet no location has been selected.

The capital stock of the American Roll & Foundry Co., Canton, O., has been increased from $200,000 to $300,000.

The Walworth Run Foundry Co., Cleveland, has completed the erection of an addition to its plant. A new building 50 x 150 feet of brick construction, four stories high, has been constructed and will be used for the casing ring, register and steel stamping departments, as well as for cleaning castings. One floor of this building is used for the storage of patterns.

The Aluminum Foundry Co., Manitowoc, Wis., which makes a specialty of aluminum castings for automobiles, has in contemplation additions to its plant, plans for which are still undeveloped.

The plant of the Westerville Foundry & Machine Co., Westerville, O., which was recently purchased by J. W. Hance, formerly treasurer and general manager of the Hance-Brown Castings Co., Columbus, O., is now being operated under the firm name of the J. W. Hance Foundry Co. The plant has a capacity of eight tons of gray iron daily.

Benjamin Pues, formerly foreman of the Jackson Foundry & Machine Co., Metropolis, Ill., together with Harry Meers and Pratt Piggott, has begun the erection of a new foundry, 75 x 80 feet.

The Torrance Malleable Iron Works has broken ground at Voorheesville, a suburb of Albany, N. Y., for the erection of a large malleable plant. The main building will be 400 feet long and will be erected on a tract of land between the Delaware & Hudson and the West Shore railroads.

New Construction.

The contract for the erection of the new foundry for Chas. F. Schaefer, Thirty-fifth street and Gray's Ferry road, Philadelphia, has been awarded to the Wm. Steel Sons Co. The building will be 50 x 100 feet.

The Auburn Foundry Co., Auburn, Ind., recently incorporated with a capital stock of $15,000, has a new foundry under construction, which will be ready for occupancy about July 1. While light and medium gray iron castings will be made, especial attention will be given to the production of automobile castings of all descriptions. F. W. Payne is secretary and treasurer of the concern.

The E. Killing Molding Machine Works, manufacturer of molding machines, Davenport, Ia., will be extended by the erection of a new foundry 50 x 100 feet. The equipment in the present foundry will be installed in the new plant and a number of Killing molding machines will be used.

The Valley Foundry Co., Canal Dover, O., has commenced the erection of a new plant. Considerable new machinery will be purchased.

The Comee Metallic Packing Co., Stevens Point, Wis., will erect a new foundry 32 x 70 feet. The Nathan Mfg. Co., Singer building, New York City, is the eastern agent of this concern.

The Great Northern Stove Mfg. Co., Minneapolis, has secured a tract of five acres, upon which a modern stove manufacturing plant will be erected. The main building will be four stories high, of brick construction, 60 x 250 feet. The foundry will be 80 x 250 feet, and the warehouse two stories 30 x 200 feet. By means of side tracks direct connections will be made with the Northern Pacific and Great Northern Railroads.

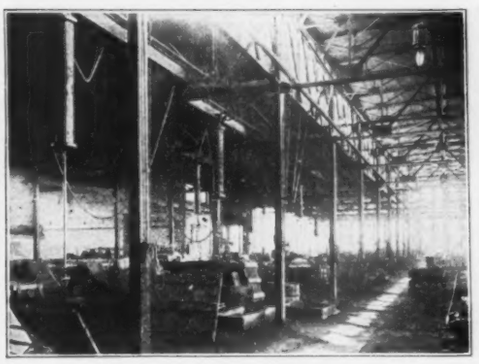
The American Manganese Bronze Co., 99 John St., New York City, will make a specialty of copper alloys, brought out by Chas. R. Spare, formerly chemist at the Cramps ship yards, Philadelphia. Among the products are included Spare's manganese bronze, Spare's white bronze, Spare's hydraulic bronze. The company will also manufacture United States government alloys and will specialize on marine hydraulic work. A plant will be built on the outskirts of Philadelphia at Holmesburg, Pa. U. T. Hungerford is president of this concern, Chas. R. Spare, vice president, and Wm. A. Loske is secretary and treasurer.

The John J. Bruce Foundry Co. has recently removed from its former location, 942-956 Kenyon avenue, Cincinnati, to its new plant, 2415-2423 Colerain avenue. The main building is 100 x 150 feet and contracts have recently been awarded for a pattern shop 50 x 80 feet. The first heat was made on May 19 and consisted of 15 tons. It was completed in one hour and fifty-five minutes.

The United Metals Casting Co., Cleveland, has been incorporated with a capital stock of $10,000 to engage in the manufacture of plumbers' supplies, automobile trimmings, etc. A brass foundry will probably be erected. The incorporators are W. C. Rhodes, C. F. Ackerman, Edith M. Fasig, Chas. H. Taylor and C. F. Taplin.

The Fred M. Prescott Steam Pump Co., Milwaukee, is erecting a pattern storage house 100 x 100 feet.

The Pacific Malleable Castings Co. will erect a plant at Riverside, Cal., for the manufacture of malleable castings. Two buildings will be erected, each 60 x 200 feet. The plant will be placed in operation about Dec. 1, and will be in charge of William F. Kerr, formerly superintendent of the foundry of the Chisholm & Moore Mfg. Co., Cleveland.



General View of Manufacturers' Foundry Company, Milwaukee, Wis., showing installation of Pneumatic Cranes

Complete Equipment furnished for this Foundry

COMPLETE FOUNDRY PLANTS.

Foundry Cranes of Every Description

ELECTRIC—PNEUMATIC—HAND POWER

WHITING CRANES ARE CONSTRUCTED FOR SERVICE

Cupolas
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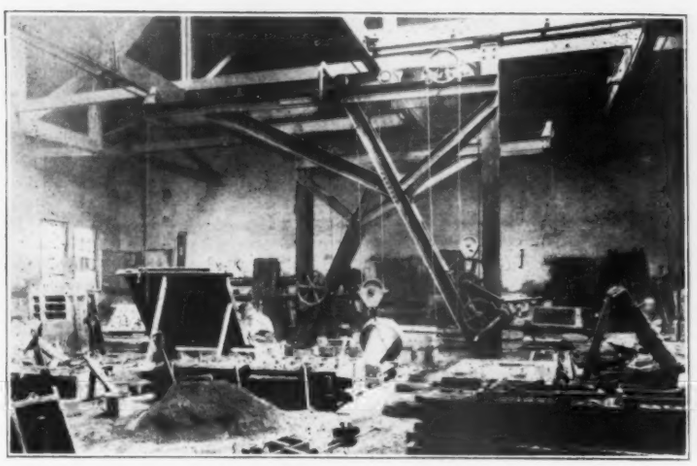

Jib Cranes in Foundry

Air Hoists
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Sand Sifters
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Trolleys
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Brass Furnaces
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Cupola Accessories
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Charging Machines

HAND POWER, STEEL FRAME, UNDERBRACED JIB CRANE

Jib Cranes of Every Type

In many situations jib cranes are the best type where same lifting operations are constantly repeated and economy of space is not essential. They are also largely used to supplement electric traveling cranes and render the service doubly efficient.

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WHITING FOUNDRY EQUIPMENT CO.

MANUFACTURERS ENGINEERS DESIGNERS

HARVEY, ILL. (Chicago Suburb.)

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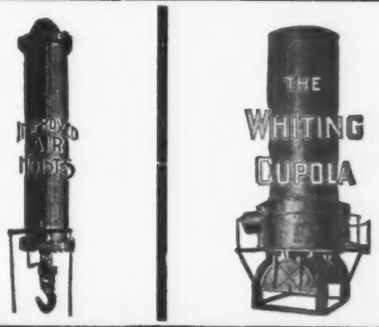
If not, tell us.



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The advantages in the use of STEVENS' GENUINE EAST INDIA PLUMBAGO are all the possible advantages that come from the use of the very best facing known to Foundry Practice.

It is absolutely pure, a little of it accomplishes better results than a good deal of anything else, hence it goes a long ways in the saving of labor, time and money.

Prove all this by trying a barrel at my risk. If it doesn't suit, I stand the loss—that's the "Stevens System."

If you are making loam or dry sand molds and you are not using STEVENS' CARBON BLACKING you are missing one of the golden opportunities. Equally good as a core wash. Quality, all in the blacking; not necessary to add molasses nor anything else, plain every-day water is sufficient.

The same pocket-book quality permeates all the facings I manufacture, and I manufacture them all.

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Buffalo Forge Co., Buffalo, N. Y.
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American Wire Brush Co., New York.
Osborn Mfg. Co., Cleveland.
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Shelton Metallic Filler Co., Derby, Conn.
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Pangborn Company, Thomas W. New York.
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Sum up your **PLUMBAGO** story by showing the buyer that by using our **No. 48,** he will have a high grade material for his good work; can add 50% soapstone and have the equivalent of the average 3½c or 4c goods, to be used on work with which he is not so particular.

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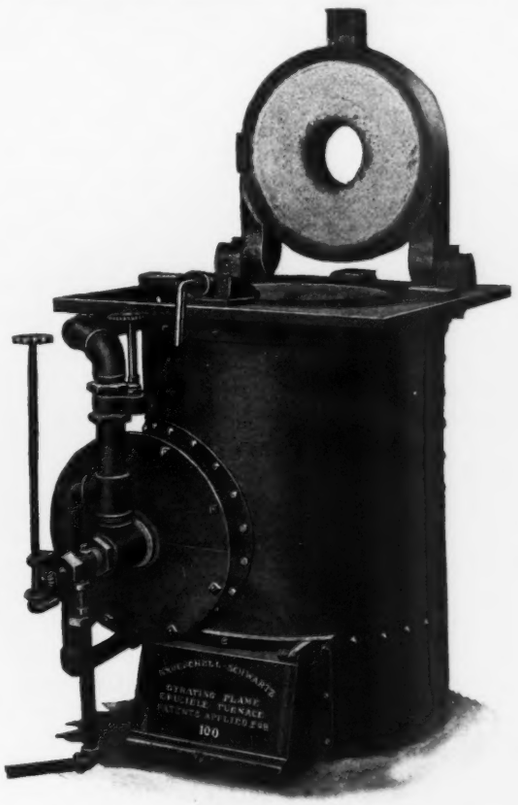

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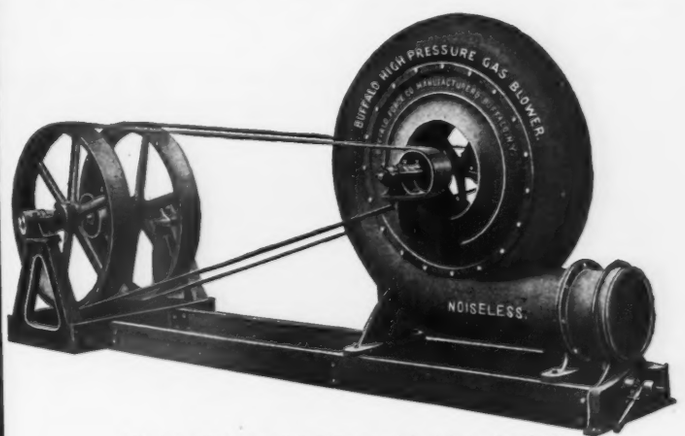

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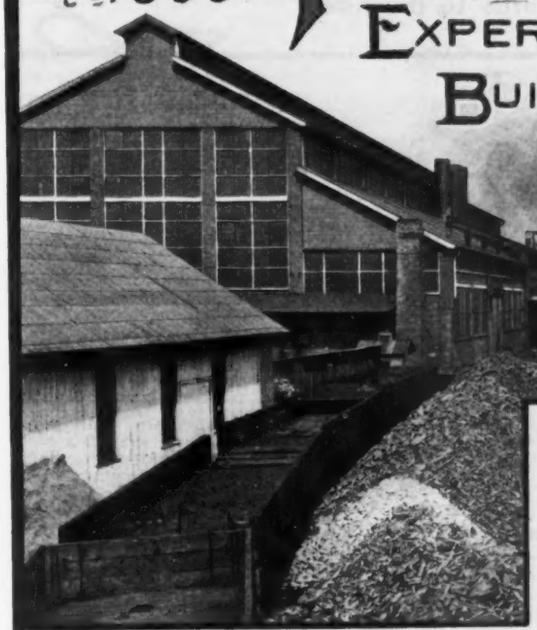

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A FIRST CLASS TABOR ROCKOVER molding machine hand wanted. Must come well recommended. Steady work to the right man. Address Box 813, THE FOUNDRY, Cleveland, O.

FIRST CLASS CORE BOSS WANTED for a malleable iron foundry making journal boxes, draw bars and draft riggings. State references and salary. Address Box 816, THE FOUNDRY, Cleveland, O.

SUPERINTENDENTS WANT POSITIONS

POSITION WANTED AS SUPERINTENDent or foreman in foundry of large plant where practical methods are used, and where positive results will return large salary. Applicant is a young man, 39 years old, and married, and has had 20 years' experience on engines, steam and gas, pumps, air compressors, and a general line of job work. Thoroughly understands cupola practice, core room from start to finish, and the general line of brass. Am up against a cost system here which demands production below the minimum of castings, and reason for desiring change, have advanced as far as is possible under the existing conditions, and want larger field, have now 70 men, versed in molding, machinery, stripping plating, rockover, and all the latest labor saving devices. Will take shop at fair salary and a percentage of saving in labor cost. At liberty August 1st. Address Box 823, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS SUPERINtendent in large brass foundry; valves specialty. 16 years' experience. Up-to-date on molding machines and modern melting, also chemist. Western states preferred. Address Box 804, THE FOUNDRY, Cleveland, Ohio.

POSITION WANTED AS SUPERINTENDent or foreman by man thoroughly capable of taking entire charge of gray iron foundry making light or medium weight castings. Address Box 815, THE FOUNDRY, Cleveland, O.

POSITION WANTED ON ARCHITECtural and ornamental iron work. Superintendent seeks a change. Experienced in all departments. Expert patternmaker, modern foundry practice, molding machines, cupola and mixture of metals, brass and bronze. Up-to-date on finishing shop methods. Can handle work from start to finish. Will furnish first-class references. Address Box 772, THE FOUNDRY, Cleveland, O.

FOREMANSHIP WANTED

POSITION WANTED BY UP-TO-DATE foundry foreman well up in molding machine practice. Can handle men to advantage on any class of foundry work. Strictly temperate. Address Box 805, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOREMAN OR assistant foundry foreman; 32 years old, 16 years in general jobbing foundry, four years of this foreman. Can furnish good references on light and heavy work, green or dry sand. Address Box 780, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY foreman. Am 41 years of age and have had 19 years' experience as molder; over 10 years as foreman. Understand molding machines and can mix iron for light and heavy work. Can handle men at minimum cost. Address Box 793, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY foreman or superintendent. Practical in every detail of machine molding and core making. Eighteen years' experience, nine years with Sargent & Co., New Haven, Conn. References. Address H. R. J., 1470 Chapel street, New Haven, Conn.

POSITION WANTED BY ENERGETIC, up-to-date foundry foreman, who understands his business all the way through, on light or heavy work. Expert with molding machines. Address Box 819, THE FOUNDRY, Cleveland, O.

POSITIONS WANTED, MISCELLANEOUS

POSITION WANTED BY EXPERIENCED molder in good shop, or would take charge of small foundry. Country preferred. I. C. S. student. Address Box 796, THE FOUNDRY, Cleveland, O.

CHANGE DESIRED BY ORNAMENTAL iron draftsman with seven years' experience in the ornamental iron business and capable of taking charge of drafting room. Address Box 821, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY FIRST CLASS malleable iron annealer. Address Box 818, THE FOUNDRY, Cleveland, Ohio.

BUSINESS OPPORTUNITIES

INVENTORS ATTENTION: MERITOrious patented foundry machinery manufactured on royalty basis. Long experience and unexcelled facilities for reaching foundry trade. Whiting Foundry Equipment Company, Harvey (Chicago Suburb), Ill.

WANTED TO PURCHASE OR WORK on royalty, articles relating to modern foundry equipment, which will guarantee economy and a saving of labor over present methods. Forward blue prints or patterns. Address Box 822, THE FOUNDRY, Cleveland, O.

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FOR SALE. JOBBING FOUNDRY AND stove repairs carrying all the latest patterns used in this intermountain country, trade increasing all the time, but on account of our other business interests will sell all or will take some stock in the business. Correspondence solicited. Address Box 812, THE FOUNDRY, Cleveland, O.

FOUNDRY FOR SALE OR RENT; in city of 100,000 with over an acre of ground, private siding and electric power plant. Buildings and equipment in good condition. For particulars address, Roeper-Kincaid Mfg. Co., Reading, Pa.

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Roots Second-Hand Blowers, bought, sold, or exchanged for new ones. Address,
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ONE ROOT'S NO. 6 FOUNDRY BLOWER for sale. First class condition. Address The Wehrle Co., Newark, Ohio.

ONE SECOND HAND NO. 5 ROOT blower for sale cheap, in good running order. The Portsmouth Stove & Range Co., Portsmouth, O.

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ONE 18 IN. X 22 IN. X 6 IN. POWER ram split pattern molding machine for sale, made by Tabor Mfg. Co., Philadelphia. Is fitted with vibrator and has one pattern plate drilling jig. This machine is brand new and has never been used. The Murray Co., Dallas, Texas.

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1—No. ½ Roots blower.
1—Nos. 2 and 5 Baker blowers.
1—Each Nos. 5, 6 and 9 Sturtevant.
1—Seller's centrifugal sand mixer.
1—1200-lb. capacity Sulky ladle. 1—400-lb. cap. Sulky Ladle.
1—54" Crandall cupola.
15—Barnett Flasks 16 x 16 x 3" cope and 2" drag.
1—30 x 52" steel shell exhaust rumbler.
1—36" x 48" C. I. rumbler.
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1—Sprue cutter, belt power.
1—13 ton Geared Ladle.
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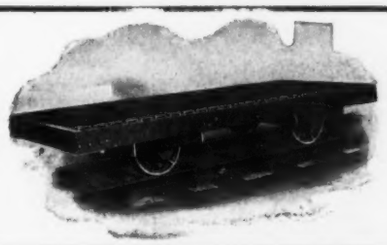

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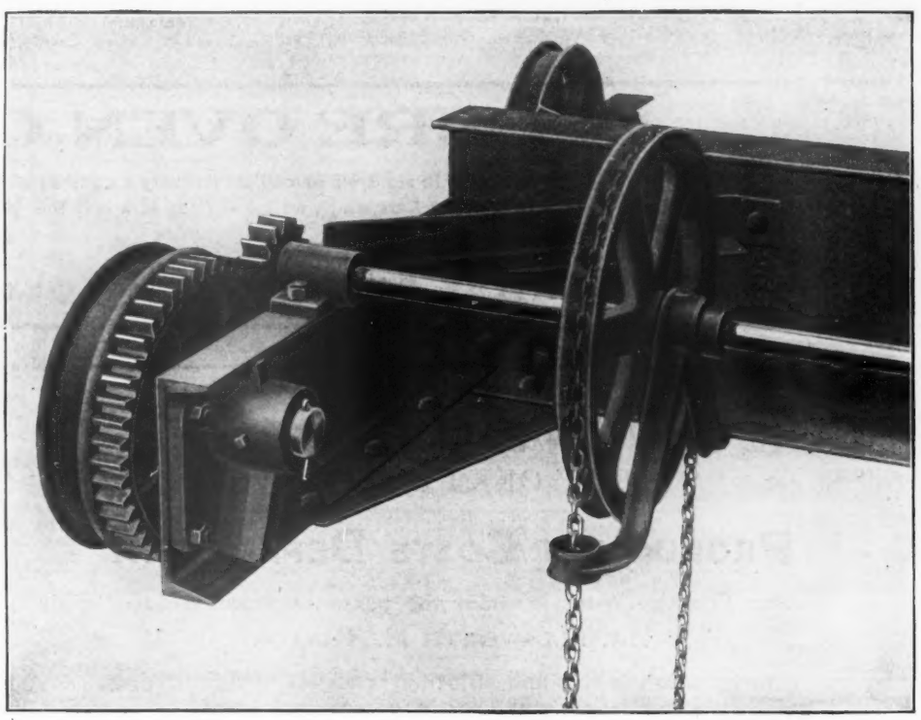

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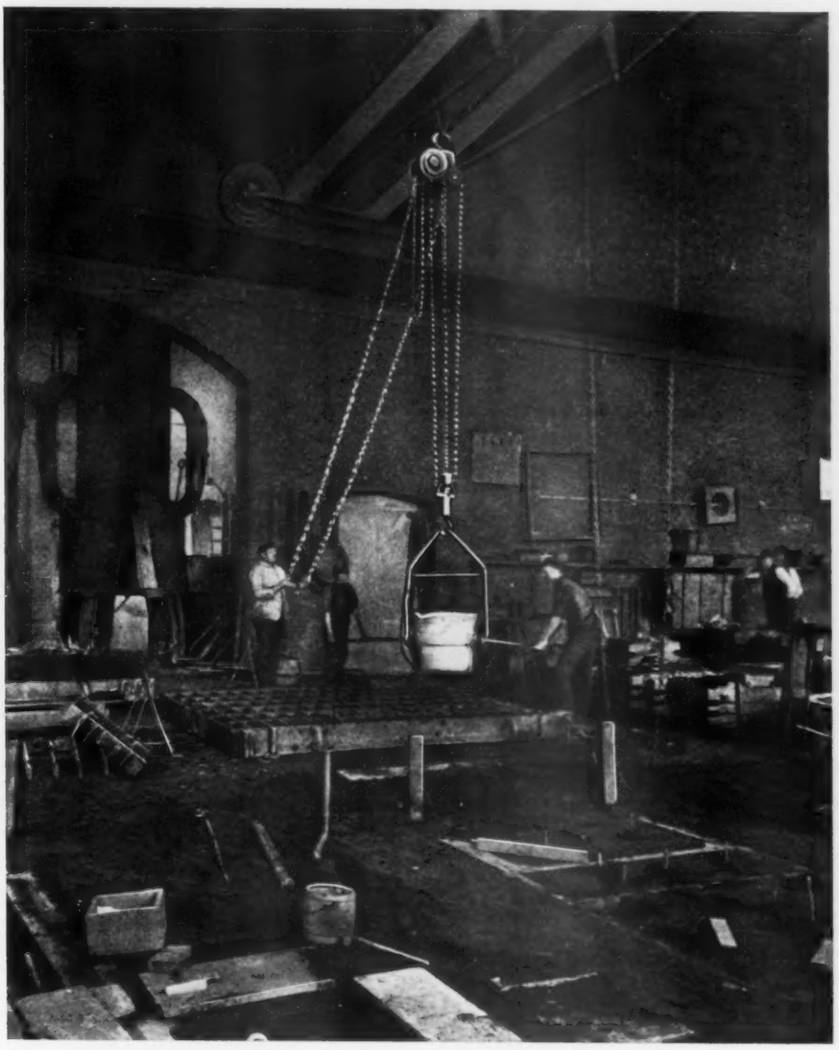
Y  T

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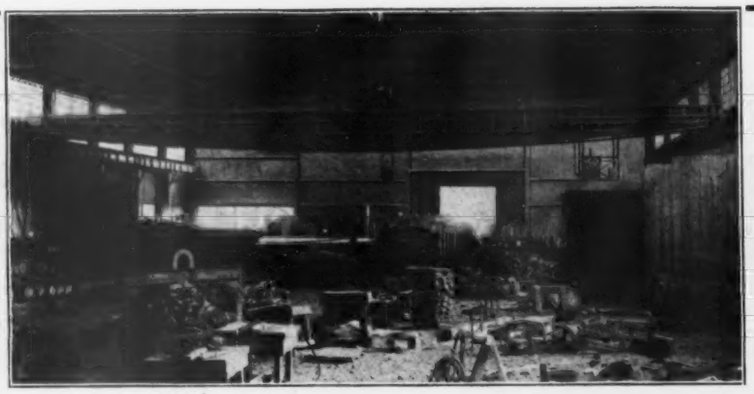

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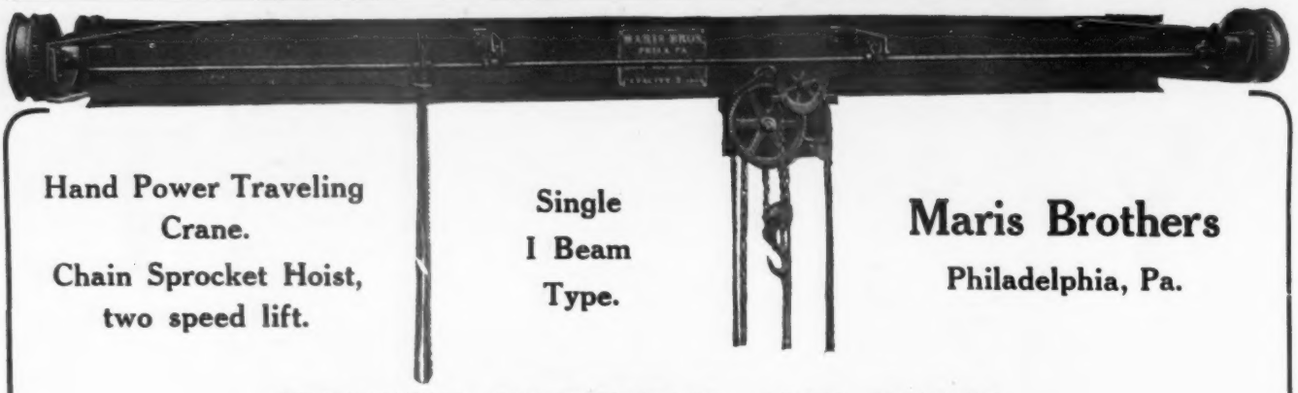

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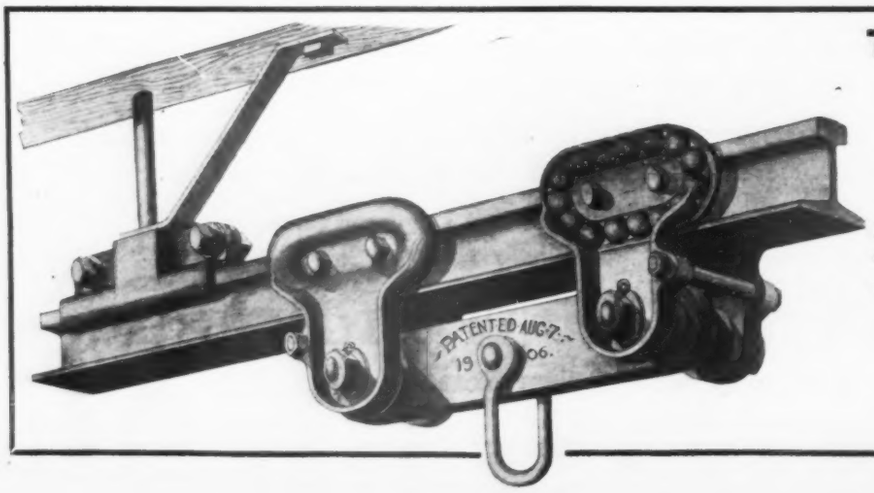

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